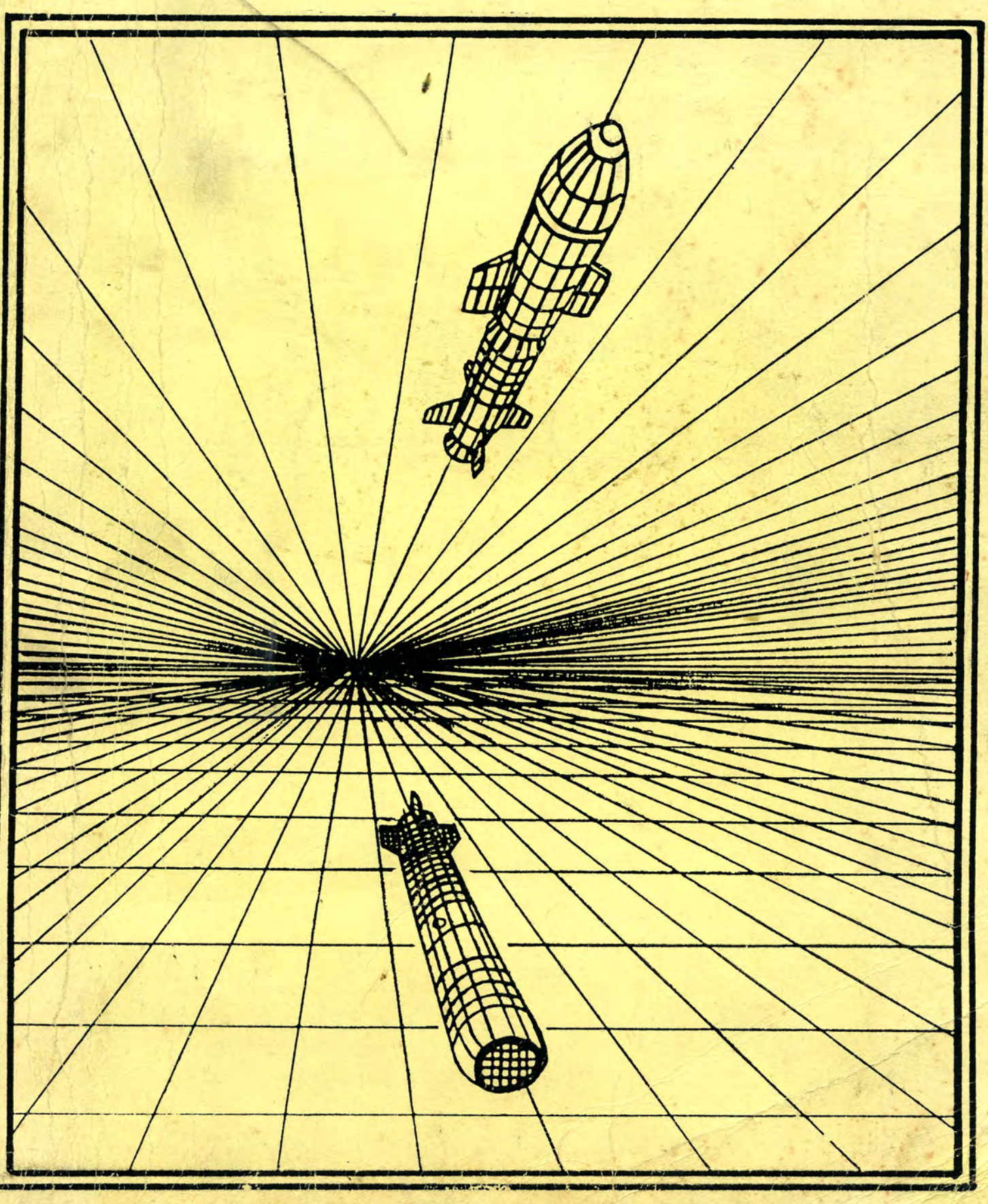
S.A.W.'s

S.F.C.S. HANDBOOK



RAN SUBMARINE SCHOOL
HMAS PLATYPUS
1st. JANUARY 1988

SAW'S SFCS HANDBOOK

ALL INFORMATION IN THIS BOOK HAS BEEN UPDATED TO SFCS MOD. 1 STATUS.

IT MUST BE EMPHASISED THAT THIS BOOK IS TO BE USED AS A GUIDE AND MUST NOT BE USED AS AN AUTHORISED OPERATING MANUAL OR AN OFFICIAL RAN PUBLICATION. ALWAYS REFER TO THE APPROPRIATE BR.ABR. AND WEED'S STANDING ORDERS.

ANY AMENDMENTS OR CORRECTIONS SHOULD BE FORWARDED TO THE RANSS SFCS INSTRUCTOR TO ENSURE THAT INFORMATION CAN BE UPDATED AND ALL MAINTAINERS CAN BE INFORMED.

(W.W. GRIERSON)
COMMANDER RAN
OFFICER IN CHARGE
RAN SUBMARINE SCHOOL

(P. SOLOMON)
CPOETS(S/M)
SFCS INSTRUCTOR
RAN SUBMARINE SCHOOL

SAW's SFCS HANDBOOK INDEX

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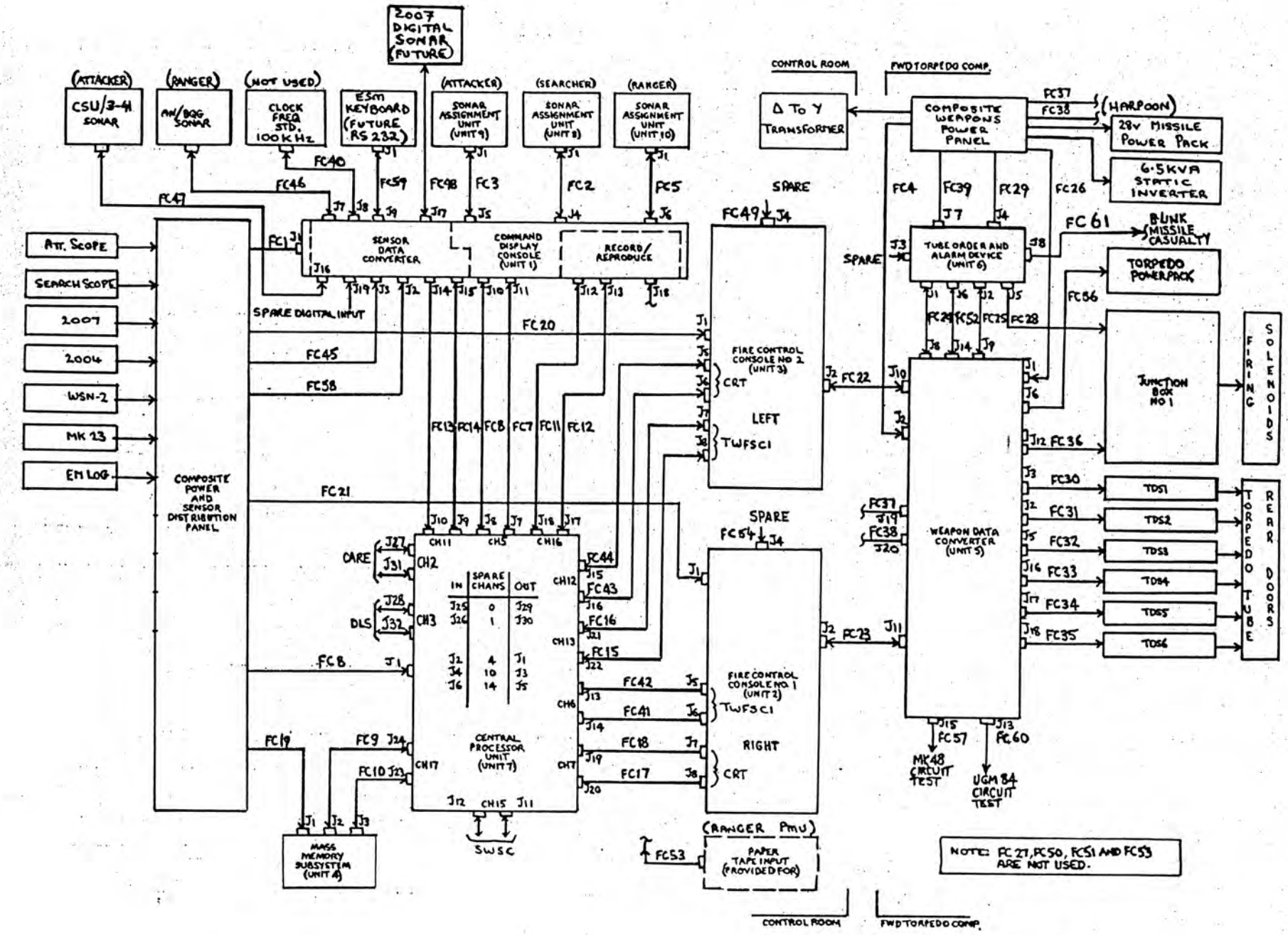
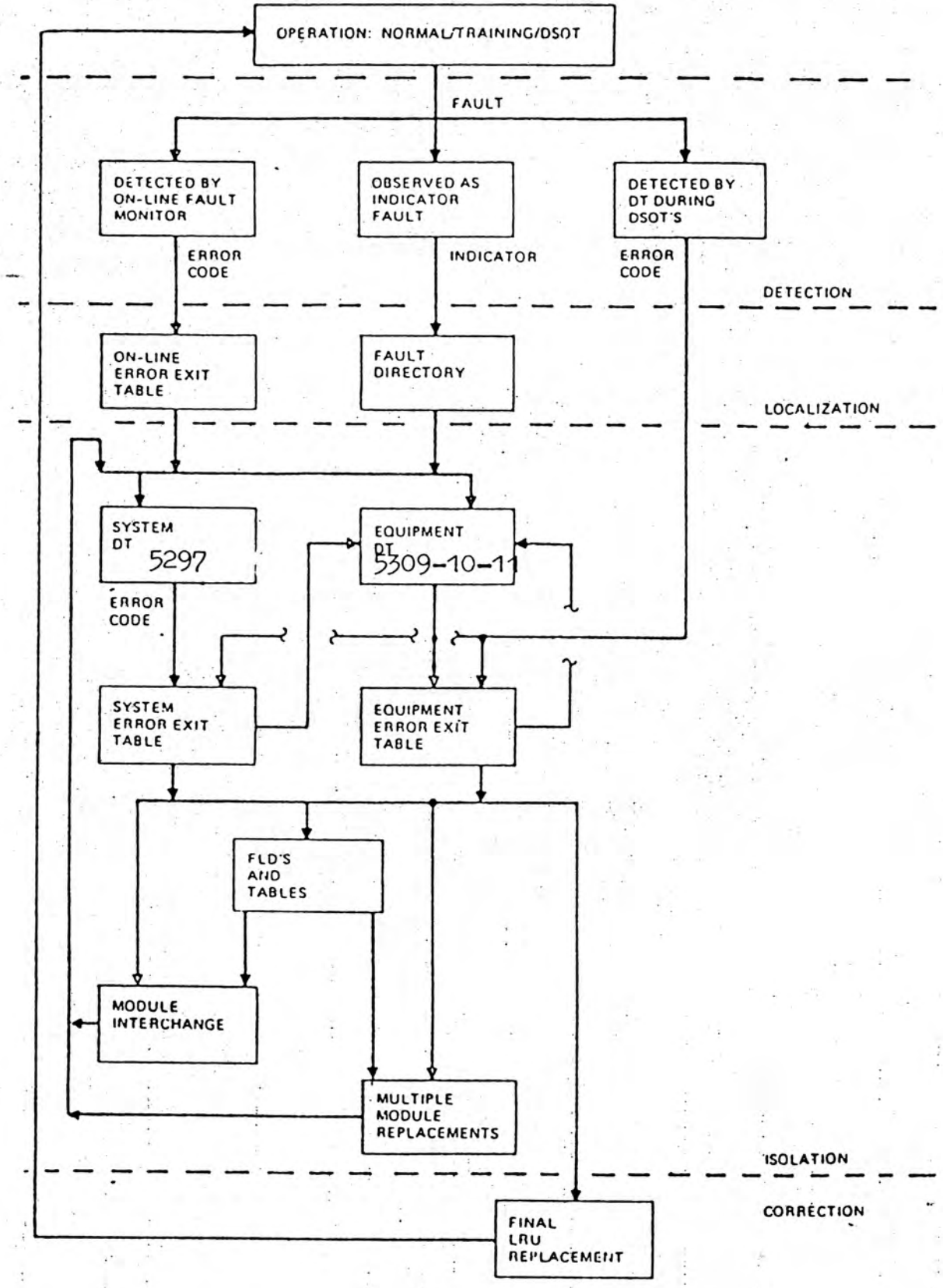


SFCS SYSTEM CABLING BLOCK DIAGRAM



CORRECTIVE MAINTENANCE FLOW DIAGRAM

U1600EM COMPUTER DIAGNOSTICS REV.103 VERSION

THE FOLLOWING U1600EM COMPUTER DIAGNOSTICS ARE INTENDED TO REPLACE THE DIAGNOSTICS CONTAINED IN TEM 1427-0001-4 SPERRY UNIVAC U1600 TECHNICAL MANUAL, CHAPTER 11, VOLUME FOUR, PARAGRAPH 11-19. ALL PARAGRAPHS REFERENCEI IN THIS DIAGNOSTIC PROCEDURE REFER TO THAT PUBLICATION, ie, FOR FAULT FINDING PURPOSES AND ERROR REFERENCING.

ALL OF THESE DIAGNOSTICS HAVE BEEN UPDATED TO REV.103 STANDARD TO DATE JANUARY 1988.

DIAGNOSTICS COVERED IN THIS SECTION

POWER ON PROCEDURE
MICRO DIAGNOSTIC PROCEDURE
U1600 DIAGNOSTIC LOADING PROCEDURE
CP/MEMORY DIAGNOSTICS
I/O DIAGNOSTICS
OPTIONS DIAGNOSTICS

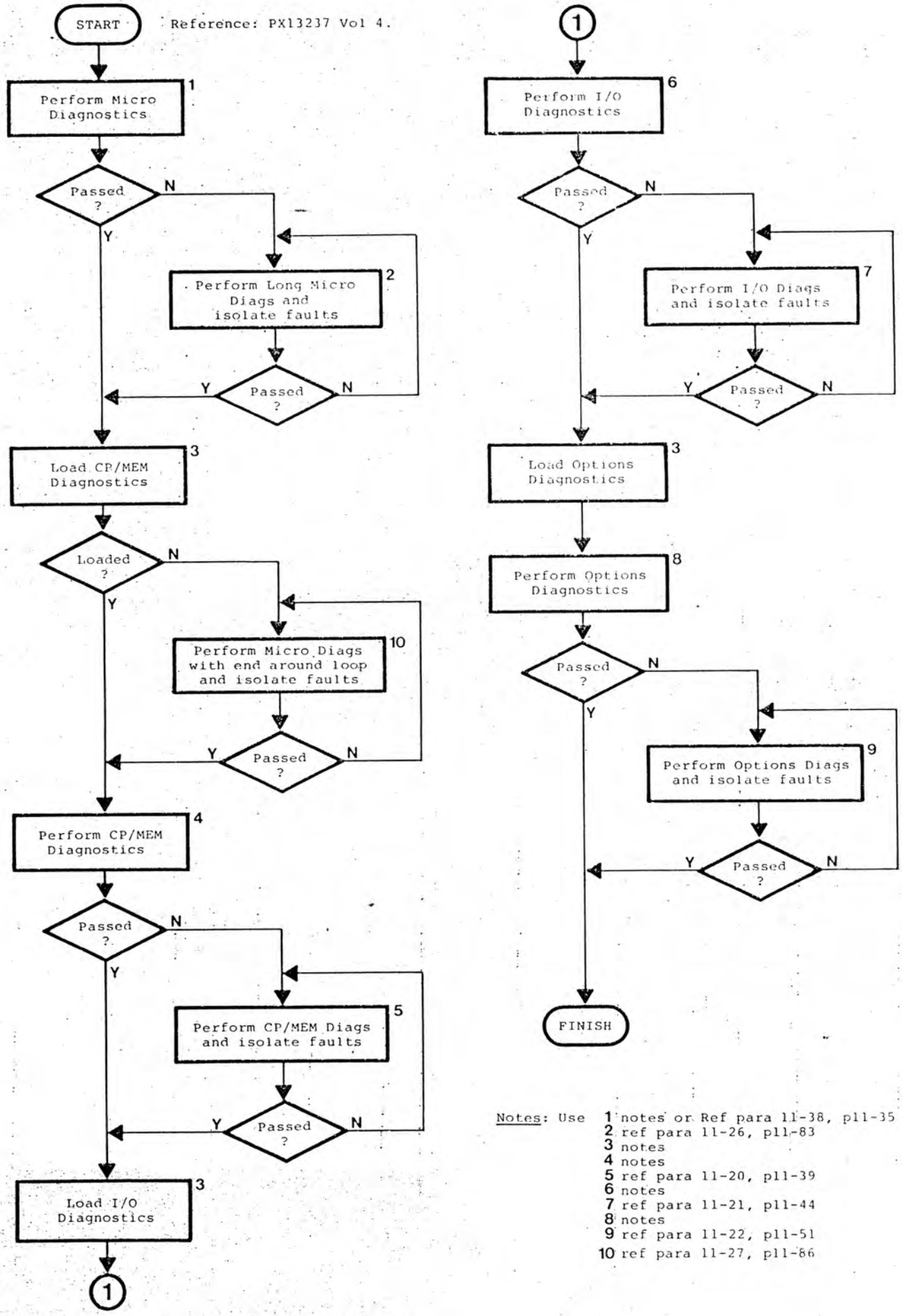
U1600 DOCUMENTATION INDEX. (PX 13237)

THE PX 13237 MANUALS ARE DIVIDED INTØ SIX VOLUMES WITH FIVE MAIN AREAS.

VOLUME	SECTION	REMARKS
1	CHAPTER 1	GENERAL INFORMATION
	CHAPTER 2	OPERATION
	CHAPTER 3	FUNCTIOAL DESCRIPTION
	CHAPTER 4	SCHEDULED MAINTENANCE
	CHAPTER 5	TROUBLE SHOOTING
	CHAPTER 6	CORRECTIVE MAINTENANCE
	CHAPTER 7	PARTS LIST
	CHAPTER 8	INSTALLATION
2	APPENDIX A	MACRO INSTRUCTIONS
	APPENDIX B	CPU REFERENCE DATA
	APPENDIX C	MICRO INSTRUCTIONS
	APPENDIX D	MPC OPERATION
	APPENDIX E	MICRO PROGRAMME LISTING
	APPENDIX F	CPU LANGLEY CONFIGURATION
3	CHAPTER 9	CP/IOC CIRCUIT DIAGRAMS
	CHAPTER 10	EXPANDED MEMORY DIAGRAMS
	APPENDIX A	DEVICE DESCRIPTIONS
4	CHAPTER 11	DIAGNOSTIC TESTS
5 & 6	CHAPTER 12	DIAGNOSTIC PROGRAMME LISTINGS

U1600 FAULT FINDING FLOW DIAGRAM

Reference: PX13237 Vol 4.



Notes: Use
1 notes or Ref para 11-38, p11-35
2 ref para 11-26, p11-83
3 notes
4 notes
5 ref para 11-20, p11-39
6 notes
7 ref para 11-21, p11-44
8 notes
9 ref para 11-22, p11-51
10 ref para 11-27, p11-86

POWER ON PROCEDURE

REFERENCE: VOLUME 4, PARAGRAPH 11-17

1. ENSURE COMPUTER POWER BLOWER AND POWER LOGIC ARE OFF.
2. OPEN COMPUTER DOOR.
3. ENSURE ALL SWITCHES SET AS IN TABLE BELOW:

MAINTENANCE PANEL

a)	PROGRAM STOP 1/OFF	OFF
b)	PROGRAM STOP 2/OFF	OFF
c)	ALTER MODE SET/CLEAR	SET
d)	DIAGNOSTIC JUMP	DOWN
e)	DIAGNOSTIC DISPLAY	DOWN
f)	PROCESSOR DISABLE RT CLOCK	INT
g)	PROCESSOR DISABLE ADV. P	DOWN
h)	PROCESSOR DISABLE I/C TIME OUT	DOWN
i)	BREAK POINT READ/OFF	OFF
j)	BREAK POINT WRITE/OFF	OFF
k)	AUTO START/START	CENTRE
l)	TEST/NORMAL SWITCH (CARD C23)	RIGHT

OPERATORS PANEL

a)	BOOTSTRAP LOAD/STOP	CENTRE
b)	BOOTSTRAP 1/2	1 (R/R), 2(MMU)
c)	CIRCUIT BREAKER ON/OFF	ON
d)	BATTLESHORT ON/OFF	OFF

4. SET POWER BLOWER ON/OFF SWITCH TO ON.
5. OBSERVE POWER BLOWER INDICATOR IS LIT.
6. ENSURE ALL THREE BLOWERS ARE RUNNING CORRECTLY.
7. SET POWER LOGIC ON/OFF SWITCH TO ON.
8. OBSERVE FAULT POWER INDICATOR ON THE OPERATORS PANEL IS OUT.
9. OBSERVE FAULT POWER INDICATOR ON THE MAINTENANCE PANEL IS OUT.
10. OBSERVE MAINTENANCE PANEL PROGRAM RUN INDICATOR IS OUT.
11. OBSERVE PROGRAM STOP INDICATOR IS OUT.

MICRO DIAGNOSTIC PROCEDURE

REFERENCE: VOLUME 4, PARAGRAPH 11-18

THE MICRO DIAGNOSTIC PROGRAM IS CONTAINED WITHIN THE U1600EM COMPUTER AND DOES NOT REQUIRE LOADING FROM AN EXTERNAL SOURCE.

1. CARRY OUT POWER ON PROCEDURE BEFORE STARTING MICRO DIAGNOSTICS.
2. PRESS DISPLAY SELECT CLEAR BUTTON, DISPLAY NUMBER SHOULD BE 00.
3. PRESS MODE MICRO STEP INDICATOR, INDICATOR SHOULD BE LIT.
4. SET DIAGNOSTIC JUMP SWITCH UP.
5. PRESS MASTER CLEAR PUSH BUTTON.
6. OBSERVE MODE RUN INDICATOR, INDICATOR SHOULD BE LIT.
7. PRESS GENERAL REGISTER INDICATOR, INDICATOR SHOULD BE LIT.
8. PRESS DISPLAY NUMBER INDICATORS 3, 2, AND 1 (R/R LOAD), 3,2,1,0 (MMU LOAD), INDICATORS SHOULD BE LIT.
9. PRESS PROGRAM RUN INDICATOR, INDICATOR SHOULD BE LIT.
10. PRESS AUTO START/START SWITCH TO START FOUR TIMES.
11. PRESS DISPLAY SELECT CLEAR PUSH BUTTON.
12. OBSERVE PROGRAM RUN INDICATOR, INDICATOR SHOULD BE OUT.
13. OBSERVE REGISTER/DATA INDICATORS, VALUE DISPLAYED SHOULD BE 0/70707.
14. OBSERVE FAULT PROGRAM INDICATOR, INDICATOR SHOULD BE OUT.
15. OBSERVE DISPLAY NUMBER INDICATORS, VALUE SHOULD BE 00.
16. SET DIAGNOSTIC JUMP SWITCH DOWN.

IF ANY FAILURE OCCURS DURING MICRO DIAGNOSTICS REFER TO VOLUME FOUR OF U1600 TECHNICAL MANUAL FOR ERROR ISOLATION USING LONG MICRO DIAGNOSTIC PROCEDURES IN PARAGRAPH 11.26.
IF MICRO DIAGNOSTICS FAIL AT STEP 13, (VALUE NOT 0/70707), COMMENCE LONG MICRO DIAGNOSTICS AT STEP THREE.

U1600EM DIAGNOSTICS LOADING PROCEDURE

REFERENCE: VOLUME 4, PARAGRAPH 11-19

THE FOLLOWING STEPS LOAD THE U1600 DIAGNOSTICS MENU TO ENABLE SELECTION OF THE TEST REQUIRED, ie, CP/MEMORY, INPUT/OUTPUT, OPTIONS.
MICRO DIAGNOSTICS MUST HAVE PASSED BEFORE ATTEMPTING TO LOAD U1600 MENU.

1. CARRY OUT MICRO DIAGNOSTICS.
2. PRESS STOP SWITCH.
3. SET BOOTSTRAP SWITCH AT 1 FOR AN R/R LOAD, AT 2 FOR A MMU LOAD.
4. SET BOTH DIAGNOSTIC SWITCHES DOWN.
5. PRESS MMU RESET SWITCH.
6. SET PROGRAM STOP 1 AT 1, PROGRAM STOP 2 AT OFF.
7. PRESS MASTER CLEAR PUSH BUTTON.
8. SET P REGISTER TO 0/00002.
9. PRESS AUTO START/START SWITCH TO START.
10. CHECK RUN INDICATOR IS OUT AND P = 0/00070.
11. PRESS AUTO START/START SWITCH TO START.
12. CHECK RUN INDICATOR IS OUT AND AGAIN P = 0/00070.
13. PRESS AUTO START/START SWITCH TO START. 27 Rev 104
14. CHECK RUN INDICATOR IS OUT AND P = 1/72133. (UPDATED REV 103 VALUE)
15. SELECT GENERAL REGISTER 00 AND ENTER APPROPRIATE OCTAL VALUE FOR DESIRED TEST AS LISTED IN MENU BELOW:

GR00 OCTAL VALUE	TEST REQUIRED	P CHECK ADDRESS
a) 20	CP/MEMORY	0/00000
b) 21	I/O TEST	0/00000
c) 22	OPTIONS TEST	0/00000
d) 23	MMU DACLASSIFICATION	0/00000

16. SET PROGRAM STOP 1 AT OFF.
17. PRESS AUTO START/START SWITCH TO START.
18. CHECK RUN INDICATOR IS OUT AND P EQUALS THE P CHECK ADDRESS IN THE TABLE ABOVE.

IF THE U1600 DIAGNOSTICS FAIL TO LOAD REFER TO VOLUME FOUR OF THE U1600 TECHNICAL MANUAL, PARAGRAPH 11-27 FOR LONG MICRO DIAGNOSTICS WITH END AROUND LOADING ROUTINE.

CENTRAL PROCESSOR/MEMORY DIAGNOSTICS

REFERENCE: VOLUME 4, PARAGRAPH 11-20

1. LOAD CP/MEMORY DIAGNOSTICS USING U1600 DIAGNOSTIC LOADING PROCEDURES.
2. CLEAR GENERAL REGISTER 00.
3. SET PROGRAM STOP 1 TO OFF, PROGRAM STOP 2 TO 2.
4. SET BOOTSTRAP SWITCH TO 2.
5. SET P VALUE TO 0/00500.
6. DEPRESS START SWITCH.
7. OBSERVE PROGRAM RUN INDICATOR, INDICATOR SHOULD BE OUT.
8. OBSERVE P REGISTER, VALUE SHOULD BE 0/00522.
9. OBSERVE PROGRAM STOP INDICATOR, INDICATOR SHOULD BE LIT.
10. SET PROGRAM STOP 1 TO 1, PROGRAM STOP 2 TO OFF.
11. SET BOOTSTRAP SWITCH TO 1.
12. DEPRESS START.
13. OBSERVE PROGRAM RUN INDICATOR, INDICATOR SHOULD BE OUT.
14. OBSERVE P REGISTER, VALUE SHOULD BE 0/00532.
15. DEPRESS START. 552
16. OBSERVE PROGRAM RUN INDICATOR, INDICATOR SHOULD BE OUT.
17. OBSERVE P REGISTER, VALUE SHOULD BE 0/00551.
18. SELECT GENERAL REGISTER 04, VALUE SHOULD BE 0/00000.
19. SELECT GENERAL REGISTER 05, VALUE SHOULD BE 0/00536.
20. SELECT GENERAL REGISTER 07, VALUE SHOULD BE 0/00546.
21. SELECT P REGISTER.
22. DEPRESS START.
23. OBSERVE PROGRAM RUN INDICATOR, INDICATOR SHOULD BE OUT.
24. OBSERVE P REGISTER, VALUE SHOULD BE 0/00563.
25. SELECT GENERAL REGISTER 00 AND ENTER VALUE OF 0/00005. 8
26. SELECT GENERAL REGISTER 01 AND ENTER VALUE OF 0/00037. (SEE NOTE A)
27. SELECT GENERAL REGISTER 02 AND ENTER VALUE OF 0/00037. (SEE NOTE A)
28. SET PROGRAM STOP 2 TO 2.
29. DEPRESS START.
30. SELECT P REGISTER.
31. OBSERVE PROGRAM RUN INDICATOR, INDICATOR SHOULD BE OUT.
32. OBSERVE P REGISTER, VALUE SHOULD BE 0/00765. (SEE NOTE B)
33. OBSERVE FAULT PROGRAM INDICATOR, INDICATOR SHOULD BE LIT.

TO CYCLE STOP 2 TO OFF PRESS START

NOTE A : THIS OCTAL VALUE REPRESENTS THE NUMBER OF MEMORY BOARDS FITTED IN THE COMPUTER, IN THIS CASE FIVE, WHICH IS THE MINIMUM NEEDED FOR CORRECT OPERATION. IF MORE THAN FIVE MEMORY BOARDS ARE FITTED, THE VALUES IN STEP 26 & 27 MUST BE CHANGED.
STEP 26 REPRESENTS THE NUMBER OF MEMORY CARDS FITTED IN THE SET.
STEP 27 REPRESENTS THE NUMBER OF CARDS TO BE TESTED, IT IS NOT NECESSARY TO SET ALL OF THESE BITS IF TESTING OF ALL THE FITTED CARDS IS NOT REQUIRED.

NOTE B : THE VALUE IN STEP 32 WILL BE 0/00765 IF YOU ARE LOADING FROM R/R.
THE VALUE IN STEP 32 WILL BE 0/01045 IF YOU ARE LOADING FROM MMU.
THIS IS A PROGRAM FAULT AND WILL NOT BE RECTIFIED IN THE NEAR FUTURE. A WISR HAS BEEN RAISED ON THIS PROGRAM FAULT.

INPUT/OUTPUT DIAGNOSTIC PROCEDURE

REFERENCE: VOLUME 4, PARAGRAPH 11-21

1. LOAD I/O DIAGNOSTICS USING U1600 DIAGNOSTIC LOADING PROCEDURES.
2. TURN OFF ALL PERIPHERALS AND DISCONNECT MMU AND DLS. (SEE NOTE A)
3. SET SWITCHES AS LISTED BELOW:

A)	GENERAL DISPLAY	PRESSED	4 3
B)	DISPLAY SELECT CLEAR	PRESSED	10 8
C)	BOOTSTRAP 1/2	1	14
D)	PROGRAM STOP 1/OFF	1	15
E)	PROGRAM STOP 2/OFF	2	0 0
F)	CARD 23C TEST/NORMAL SWITCH	TEST (LEFT)	1 1
G)	MASTER CLEAR	PRESSED	

4. SET P REGISTER TO 0/00500.
5. DEPRESS START.
6. OBSERVE PROGRAM RUN INDICATOR, INDICATOR SHOULD BE OUT.
7. OBSERVE P REGISTER, VALUE SHOULD BE 0/00510.
8. SET VALUES IN THE REGISTERS AS LISTED BELOW:

A)	GR00 = 1/77777	CHANNELS TO BE TESTED. (SEE NOTE A).
B)	GR01 = 0/00000	(SEE NOTE B).
C)	GR02 = 0/30423	JUMPERED CHANNELS. (SEE NOTE C)
D)	GR03 = 0/00000	(SEE NOTE B). MMU Bit 15
E)	GR04 = 0/00000	(SEE NOTE B). RR Bit 16
F)	GR05 = 0/00000	(SEE NOTE B).
G)	GR06 = 0/00000	(SEE NOTE B).
H)	GR07 = 0/00000	(SEE NOTE B).
I)	GR10 = 0/00000	(SEE NOTE B).
J)	GR11 = 0/00000	(SEE NOTE B).
K)	GR12 = 0/00004	FOR SELECTION OF 1KHZ. INTERNAL CLOCK.
L)	GR13 = 0/00000	(SEE NOTE B).

9. SELECT P REGISTER.
10. DEPRESS START SWITCH.
11. OBSERVE PROGRAM RUN INDICATOR, INDICATOR SHOULD BE OUT.
12. OBSERVE P REGISTER, VALUE SHOULD BE 0/01073.
13. OBSERVE FAULT PROGRAM INDICATOR, INDICATOR SHOULD BE LIT.
14. SET TEST/NORMAL SWITCH ON CARD 23C TO NORMAL (RIGHT) POSITION.

NOTE A : THE VALUE IN GENERAL REGISTER 00 REPRESENTS THE CHANNELS YOU INTEND TO TEST. IF 1/77777 IS SET, ALL SIXTEEN CHANNELS WILL BE TESTED. IF TESTING OF ALL CHANNELS IS NOT REQUIRED, ONLY SET THE BITS FOR THE CHANNELS YOU WISH TO TEST.
REMEMBER THAT IF DLS IS FITTED, IT MUST BE DISCONNECTED BEFORE CARRYING OUT THIS TEST. WITH THE NEW PLUG ASSEMBLY FITTED INSIDE THE MMU IT IS NO LONGER NECESSARY TO DISCONNECT THE MMU, BUT THE INTERNAL PLUG MUST BE CHANGED OVER BEFORE ATTEMPTING THIS TEST.

NOTE B : ALL OF THESE REGISTERS ARE SET TO 0/00000 AS THEY ARE NOT USED. AS PART OF THE U1600 SET-UP IN THE RAN SFCS CONFIGURATION. SEE TABLE 11-21 IN VOLUME 4 FOR FURTHER INFORMATION ON WHAT THESE VALUES REPRESENT.

NOTE C : THIS VALUE REPRESENTS THE CHANNELS FITTED WITH JUMPERED PLUGS. THE STANDARD SET-UP WILL HAVE THESE PLUGS FITTED ON CHANNELS; 0,1,4,10,14 & 15. IF IN DOUBT AS TO YOUR SET-UP, CHECK YOUR COMPUTER REAR PLUG RACK AGAINST THE ABOVE INFORMATION.
ALL SYSTEMS LEAVING CO-DOCK WILL BE SET TO THIS STANDARD.

OPTIONAL DIAGNOSTICS PROCEDURE

REFERENCE : VOLUME 4, PARAGRAPH 11-22

THE OPTIONAL DIAGNOSTICS CONTAIN FOUR SUBTESTS. THEY ARE :

a) MAXIMUM BUFFER TEST
b) CP/MEMORY-I/O CONCURRENT TEST
c) BREAKPOINT TEST
d) POWER OUT OF TOLERANCE TEST

THESE TESTS ARE CARRIED OUT IN THE ORDER AS SHOWN ABOVE.

1. LOAD THE OPTIONS DIAGNOSTICS USING THE U1600 DIAGNOSTIC LOADING METHOD.
2. SET THE SWITCHES TO THE POSITIONS INDICATED BELOW :

a)	GENERAL DISPLAY	PRESSED
b)	DISPLAY SELECT CLEAR	PRESSED
c)	BOOTSTRAP 1/2	1
d)	PROGRAM STOP 1/OFF	1
e)	PROGRAM STOP 2/OFF	2
f)	MASTER CLEAR	PRESSED

3. SET P REGISTER TO 0/00500.
4. DEPRESS START SWITCH.
5. OBSERVE PROGRAM RUN INDICATOR, INDICATOR SHOULD BE OUT.
6. OBSERVE P REGISTER, VALUE SHOULD BE 0/00512.
7. SET GENERAL REGISTER VALUES AS LISTED BELOW :

GR00 = 0/00005
GR01 = 0/00037 (CARDS FITTED IN SET)
GR03 = 0/03677
GR04 = 0/00037 (CARDS TO BE TESTED)

8. SELECT P REGISTER.
9. DEPRESS START SWITCH.
10. OBSERVE PROGRAM RUN INDICATOR, INDICATOR SHOULD BE OUT.
11. OBSERVE P REGISTER, VALUE SHOULD BE 0/00520.
12. SET GENERAL REGISTER VALUES AS LISTED BELOW :

GR00 = 1/77777
GR01 = 0/00000
GR02 = 0/30423
GR03 = 0/00000
GR04 = 0/00000
GR05 = 0/00000
GR06 = 0/00000
GR07 = 0/00000
GR10 = 0/00000
GR11 = 0/00000
GR12 = 0/00004
GR13 = 0/00000

we got 0/01071

13. SELECT P REGISTER.
14. DEPRESS START SWITCH.
15. OBSERVE PROGRAM RUN INDICATOR, INDICATOR SHOULD BE OUT. (APPROX. 4 MIN.
16. OBSERVE P REGISTER, VALUE SHOULD BE 0/00663.

TURN TO NEXT PAGE FOR STEP 17 WHICH IS THE START OF THE MAX. BUFFER TEST.

MAXIMUM BUFFER TEST

17. SET TEST/NORMAL SWITCH ON CARD 23C TO TEST (LEFT) POSITION.
18. DEPRESS START SWITCH.
19. OBSERVE PROGRAM RUN INDICATOR, INDICATOR SHOULD BE OUT.
20. OBSERVE P REGISTER, VALUE SHOULD BE 0/00735.

CP/MEMORY-I/O CONCURRENT TEST

21. DEPRESS START SWITCH.
22. OBSERVE PROGRAM RUN INDICATOR, INDICATOR SHOULD BE OUT.
23. OBSERVE FAULT PROGRAM INDICATOR, INDICATOR SHOULD BE LIT.
24. OBSERVE PROGRAM STOP INDICATOR, INDICATOR SHOULD BE LIT.
25. OBSERVE P REGISTER, VALUE SHOULD BE 0/00750.
26. PRESS FAULT PROGRAM INDICATOR, INDICATOR SHOULD BE OUT.
27. SET TEST/NORMAL SWITCH ON CARD 23C TO NORMAL (RIGHT) POSITION.

BREAKPOINT TEST

THE BREAKPOINT TEST REQUIRES A GREAT DEAL OF OPERATOR INTERVENTION FOR ITS EXECUTION. THEREFORE, AN APPROXIMATE EXECUTION TIME IS IMPOSSIBLE TO ESTIMATE. A TOTAL OF SIX RUNS ARE REQUIRED FOR BREAKPOINT READ PORTION OF THE TEST AND SIX RUNS ARE REQUIRED FOR BREAKPOINT WRITE PORTION OF TEST.

28. DEPRESS START SWITCH.
29. OBSERVE PROGRAM RUN INDICATOR, INDICATOR SHOULD BE OUT.
30. OBSERVE P REGISTER, VALUE SHOULD BE 0/30143.
31. SET BREAKPOINT READ/OFF SWITCH TO READ.
32. SET BREAKPOINT WRITE/OFF SWITCH TO OFF.

NOTE : THE NEXT STEP WILL BEGIN THE FIRST RUN OF THE BREAKPOINT READ PORTION OF THE TEST. STEPS 33 TO 39 MUST BE REPEATED 6 TIMES.

33. SELECT GENERAL REGISTER 05, VALUE DISPLAYED SHOULD BE :

0/00000	(DURING FIRST RUN)	0/42104	(DURING FOURTH RUN)
0/10421	(DURING SECOND RUN)	1/04210	(DURING FIFTH RUN)
0/21042	(DURING THIRD RUN)	1/77777	(DURING SIXTH RUN)

34. SELECT BREAKPOINT REGISTER AND ENTER THE VALUE LISTED ABOVE, ie, 0/00000 IF ON THE FIRST RUN THROUGH, 1/77777 IF ON THE LAST RUN.
35. SELECT P REGISTER.
36. DEPRESS START SWITCH.
37. OBSERVE PROGRAM RUN INDICATOR, INDICATOR SHOULD BE OUT.
38. OBSERVE P REGISTER, VALUE SHOULD BE AS LISTED BELOW :

0/30147	(DURING FIRST RUN)	0/30155	(DURING FOURTH RUN)
0/30151	(DURING SECOND RUN)	0/30157	(DURING FIFTH RUN)
0/30153	(DURING THIRD RUN)	0/30161	(DURING SIXTH RUN)

39. DEPRESS START SWITCH.
40. REPEAT STEPS 32 TO 39 FOR THE TOTAL OF SIX RUNS. WHEN THE SIXTH RUN HAS BEEN COMPLETED, OBSERVE P REGISTER, VALUE SHOULD BE 0/30143.
41. SET BREAKPOINT READ/OFF SWITCH TO OFF.
42. SET BREAKPOINT WRITE/OFF SWITCH TO WRITE.

NOTE : THE NEXT STEP WILL BEGIN THE FIRST RUN OF THE BREAKPOINT WRITE PORTION OF THE TEST. STEPS 42 TO 49 MUST BE REPEATED 6 TIMES.
TEST CONTINUED ON NEXT PAGE. (STEP 43)

43. SELECT GENERAL REGISTER 05, VALUE SHOULD BE AS LISTED BELOW :

0/00000 (DURING FIRST RUN)	0/42104 (DURING FOURTH RUN)
0/10421 (DURING SECOND RUN)	1/04210 (DURING FIFTH RUN)
0/21042 (DURING THIRD RUN)	1/77777 (DURING SIXTH RUN)

44. SELECT BREAKPOINT REGISTER AND ENTER THE VALUE AS LISTED ABOVE, ie, 0/00000 IF ON FIRST RUN THROUGH, 1/77777 IF ON LAST RUN THROUGH.
45. SELECT P REGISTER.
46. DEPRESS START SWITCH.
47. OBSERVE PROGRAM RUN INDICATOR, INDICATOR SHOULD BE OUT.
48. OBSERVE P REGISTER, VALUE SHOULD BE AS LISTED BELOW :

0/30163 (DURING FIRST RUN)	0/30171 (DURING FOURTH RUN)
0/30165 (DURING SECOND RUN)	0/30173 (DURING FIFTH RUN)
0/30167 (DURING THIRD RUN)	0/30175 (DURING SIXTH RUN)

49. DEPRESS START SWITCH.
50. REPEAT STEPS 42 TO 49 FOR A TOTAL OF SIX RUNS. WHEN THE SIXTH RUN HAS BEEN COMPLETED OBSERVE THE P REGISTER, VALUE SHOULD BE 0/30205.
51. SET BREAKPOINT READ AND WRITE SWITCHES TO READ AND WRITE POSITION.
52. DEPRESS START SWITCH.
53. OBSERVE P REGISTER, VALUE SHOULD BE 0/30215.
54. DEPRESS START SWITCH.
55. OBSERVE P REGISTER, VALUE SHOULD BE 0/30217.
56. SET BREAK POINT READ AND WRITE SWITCHES TO OFF POSITION.
57. DEPRESS START SWITCH.
58. OBSERVE PROGRAM RUN INDICATOR, INDICATOR SHOULD BE OUT.
59. OBSERVE PROGRAM STOP INDICATOR, INDICATOR SHOULD BE LIT.
60. OBSERVE P REGISTER, VALUE SHOULD BE 0/00763.

POWER OUT OF TOLERANCE TEST

61. DEPRESS START SWITCH.
62. OBSERVE PROGRAM RUN INDICATOR, INDICATOR SHOULD BE OUT.
63. OBSERVE P REGISTER, VALUE SHOULD BE 0/30302.
64. DEPRESS START SWITCH.
65. SET START SWITCH TO AUTO START POSITION.
66. SET CIRCUIT BREAKER TO OFF FOR 5 SECONDS, THEN RETURN TO ON.
67. OBSERVE DISPLAY NUMBER INDICATORS, VALUE SHOULD BE 00.
68. OBSERVE PROGRAM STOP INDICATOR, INDICATOR SHOULD BE LIT.
69. OBSERVE PROGRAM RUN INDICATOR, INDICATOR SHOULD BE OUT.
70. OBSERVE P REGISTER, VALUE SHOULD BE 0/00776.
71. SET AUTO START/START SWITCH TO NEUTRAL (CENTRE) POSITION.
72. DEPRESS START SWITCH.
73. OBSERVE P REGISTER, VALUE SHOULD BE 0/01020.

THIS COMPLETES THE OPTIONAL DIAGNOSTICS.

MANUAL PROGRAM LOAD OR INSPECTION

THE FOLLOWING PROGRAM IS USED FOR MANUALLY LOADING A USER COMPILED PROGRAM OR INSPECTING THE CONTENTS OF CONSECUTIVE MEMORY LOCATIONS.
AFTER LOADING THIS PROGRAM THE MEMORY LOCATION WILL AUTOMATICALLY INCREMENT BY ONE EACH TIME A NEW VALUE IS ENTERED.

ENTER THE FOLLOWING PROGRAM INTO THE INDICATED MEMORY LOCATIONS:

MEMORY LOCATION	INSTRUCTION	OPERATION
0/00502	01/0/02/01	(R1) INTO R2
0/00503	05/1/00/01	R1 INTO R0, (R1)+1 INTO R1
0/00504	40/2/11/00	STOP, JUMP TO 506
0/00505	000506	
0/00506	11/1/00/02	(R0) INTO R2
0/00507	40/1/373	JUMP TO 502

1. SET P REGISTER = 0/00502
2. PRESS RUN SWITCH.
3. SET GENERAL REGISTER 1 TO MEMORY ADDRESS TO BE INSPECTED.
4. SELECT GENERAL REGISTER 0.
5. PRESS START SWITCH ONCE: THE CONTENTS OF THE FIRST ADDRESS TO BE INSPECTED SHOULD BE SHOWN IN REGISTER DATA.
6. SET NEW DATA IF REQUIRED.
7. PRESS START SWITCH ONCE: NEW WORD IS STORED AND THE NEXT WORD IS NOW DISPLAYED IN REGISTER/DATA. (ie,CONTENTS OF NEXT MEM. LOCATION)
8. SET NEW DATA IF REQUIRED.
9. CARRY ON FROM STEP 7 UNTIL PROGRAM IS LOADED OR INSPECTED.

TO ALTER THE CONTENTS OF JUST ONE MEMORY LOCATION,FOLLOW STEPS AS BELOW:

1. PRESS STOP SWITCH.
2. SELECT NORMAL DISPLAY AND GENERAL DISPLAY.
3. SET DISPLAY NUMBER = 0000 (P REGISTER).
4. SET REGISTER DATA TO THE DESIRED MEMORY ADDRESS. (ie, START ADDRESS)
5. SET DISPLAY NUMBER = 1000 (CONTENTS OF P), THE EXISTING CONTENTS OF THAT MEMORY LOCATION WILL APPEAR IN REGISTER /DATA.
6. TO MODIFY THE CONTENTS OF THE SELECTED ADDRESS, INSERT THE NEW DATA INTO THE REGISTER/DATA.

OCTAL FORMAT o f a m	HEXIDECIMAL FORMAT OP a m	CODING FORMAT	INSTRUCTION	OPERATION	C	OV	CC
00 0 – –	00 – –	–	Diagnostic return	If diagnostic jump set $R_{17} \rightarrow \mu P$	– NC –		
00 3 a m	03 a m	BL a,y,m	Byte load	(Y) byte → Ra_{7-0}; 0 → Ra_{15-8}	0	0	X
01 0 a m	04 a m	LR a,m	Load (Register)	(Rm), →, R_a	0	0	X
01 1 a m	05 a m	LI a,m	Load (Indirect)	(Y*) → R_a	0	0	X
01 2 a m	06 a m	LK a,y,m	Load (Constant)	Y → R_a	0	0	X
01 3 a m	07 a m	L a,y,m	Load	(Y) → R_a	0	0	X
02 0 a 00	08 a 0	PR a	Make positive	If $(R_a) < 0$, $(R_a)' \rightarrow R_a$	X	X	X
02 0 a 01	08 a 1	NR a	Make negative	If $(R_a) > 0$, $(R_a)' \rightarrow R_a$	X	0	X
02 0 a 02	08 a 2	RR a	Round	$(R_a) + (R_{a+1})_{15} \rightarrow R_a$ ③	X	X	X
02 0 a 04	08 a 4	TCR a	Two's Complement	$(R_a)' \rightarrow R_a$	X	X	X
02 0 a 05	08 a 5	TCDR a	Two's Complement Double	$(R_a, R_{a+1})' \rightarrow R_a, R_{a+1}$	X	X	X
02 0 a 06	08 a 6	OCR a	One's Complement	(R_a) bit-by-bit complement → R_a	0	0	X
02 0 a 10	08 a 8	IROR a	Increase R_a by 1	$(R_a) + 1 \rightarrow R_a$	X	X	X
02 0 a 11	08 a 9	DROR a	Decrease R_a by 1	$(R_a) - 1 \rightarrow R_a$	X	X	X
02 0 a 12	08 a A	IRTR a	Increase R_a by 2	$(R_a) + 2 \rightarrow R_a$	X	X	X
02 0 a 13	08 a B	DRTR a	Decrease R_a by 2	$(R_a) - 2 \rightarrow R_a$	X	X	X
02 1 a m	09 a m	LDI a,m	Load Double (Indirect)	$(Y^*, Y^*+1) \rightarrow R_a, R_{a+1}$ ③	0	0	X
02 3 a m	08 a m	LD a,y,m	Load Double	$(Y, Y+1) \rightarrow R_a, R_{a+1}$ ③	0	0	X
03 0 a 00	0C a 0	ER a	Executive Return	Generate interrupt; (P)+1 → R_a ⑤	0	0	X
03 0 a 01	0C a 1	SSOR a	Store SR1	(SR1) → R_a	0	0	X
03 0 a 02	0C a 2	SSTR a	Store SR2	(SR2) → R_a	0	0	X
03 0 a 03	0C a 3	SCR a	Store Clock	(RTC register)$_{15-0}$ → R_a	0	0	X
03 0 a 04	0C a 4	LPR a	Load P	$(R_a) \rightarrow P$	– NC –		
03 0 a 05	0C a 5	LSOR a	Load SR1	$(R_a) \rightarrow SR1$	– NA –		
03 0 a 06	0C a 6	LSTR a	Load SR2	$(R_a) \rightarrow SR2$	– NC –		
03 0 a 07	0C a 7	LCR a	Load RTC lower	$(R_a) \rightarrow$ RTC register$_{15-0}$;	– NC –		
03 0 00 10	0C 0 8	ECR	Enable Clock	Enable RTC reg. (countup and interrupt)	– NC –		
03 0 00 11	0C 0 9	DCR	Disable Clock	Disable RTC reg. (countup and interrupt)	– NC –		
03 0 a 12	0C a A	LEM a	Load and Enable Mon. clock	(R_a) → Mon. clock reg.; enable countdown and interrupt	– NC –		
03 0 00 13	0C 0 B	DM	Disable Monitor clock	Disable Mon. clock reg. (countdown and interrupt)	– NC –		
03 0 a 14	0C a C	LCRD a	Load and enable Clock Double	$(R_a, R_{a+1}) \rightarrow$ RTC; enable countup only ③	– NC –		
03 0 a 15	0C a D	SCRD a	Store Clock Double	(RTC Register) → R_a, R_{a+1} ③ ⑤	0	0	X
03 0 00 16	0C 0 E	ECIR	Enable Clock Interrupt	Enable RTC overflow interrupt	– NC –		
03 0 00 17	0C 0 F	DCIR	Disable Clock Interrupt	Disable RTC overflow interrupt	– NC –		
03 3 a m	0F a m	LM a,y,m	Load multiple	$(Y_{...} Y+m-a) \rightarrow R_a \ldots R_m$	– NC –		
# 04 0 a 00	10 a 0	SQR a	Square Root	$\surd (R_a, R_{a+1}) \rightarrow R_{a+1}$; Rem. → R_a ③	0	X	X
04 0 a 01	10 a 1	RVR a	Reverse Register	Reverse (R_a)	0	0	X
04 0 a 02	10 a 2	CNT a	Count Ones	Number of binary ones in $R_a \rightarrow R_{a+1}$	– NC –		
04 0 a 03	10 a 3	SFR a	Scale Factor	Shift (R_a, R_{a+1}) left until $(R_a)_{15} \neq (R_a)_{14}$; shift count → R_{a+2} ① ③	– NC –		
04 3 a m	13 a m	BLX a,y,m	Byte Load and index by 1	(Y) byte → R_a; $(R_m)+1 \rightarrow R_m$ ②	0	0	X
05 0 a m	14 a m	SBR a,m	Set Bit	$1 \rightarrow (R_a)_m$	0	0	X
05 1 a m	15 a m	LXI a,m	Load and index by 1 (Indirect)	$(Y^*) \rightarrow R_a$; $(R_m)+1 \rightarrow R_m$ ②	0	0	X
05 3 a m	17 a m	LX a,y,m	Load and index by 1	$(Y) \rightarrow R_a$; $(R_m)+1 \rightarrow R_m$ ②	0	0	X
06 0 a m	18 a m	ZBR a,m	Zero Bit	$0 \rightarrow (R_a)_m$	0	0	X
06 1 a m	19 a m	LDXI a,m	Load Double Index by 2 (Indirect)	$(Y^*, Y^*+1) \rightarrow R_a, R_{a+1}$; ② ③ ④ $(R_m)+2 \rightarrow R_m$ ④ ③ ②	0	0	X
06 3 a m	18 a m	LDX a,y,m	Load Double, index by 2	$(Y, Y+1) \rightarrow R_a, R_{a+1}$; $(R_m)+2 \rightarrow R_m$	0	0	X
07 0 a m	1C a m	CBR a,m	Compare Bit	Test bit m of R_a for zero	0	0	Y
07 1 00 m	1D 0 m	LPI m	Load PSW (Indirect)	$(Y^*, Y^*+1, Y^*+2) \rightarrow$ P, SR1, SR2; enable power fault interrupt	– NA –		
07 3 00 m	1F 0 m	LP y,m	Load PSW	(Y, Y+1, Y+2) → P, SR1, SR2; enable power fault interrupt	– NA –		
10 0 a m	20 a m	LRSR a,m	Logical Right Shift (Register)	Shift (R_a) right $(R_m)_{5-0}$ places, zero fill	0	0	X
10 2 a m	22 a m	LRS a,y,m	Logical Right Shift	Shift (R_a) right Y_{5-0} places, zero fill	0	0	X
10 3 a m	23 a m	BS a,y,m	Byte Store	$(R_a)_{7-0} \rightarrow Y_{byte}$	– NC –		
11 0 a m	24 a m	ARSR a,m	Algebraic Right Shift (Register)	Shift (R_a) right $(R_m)_{5-0}$ places, sign fill	0	0	X
11 1 a m	25 a m	SI a,m	Store (Indirect)	$(R_a) \rightarrow Y^*$	– NC –		
11 2 a m	26 a m	ARS a,y,m	Algebraic Right Shift	Shift (R_a) right Y_{5-0} places, sign fill	0	0	X
11 3 a m	27 a m	S a,y,m	Store	$(R_a) \rightarrow Y$	– NC –		
12 0 a m	28 a m	LRDR a,m	Logical Right Double shift (Register)	Shift (R_a, R_{a+1}) right $(R_m)_{5-0}$ places, zero fill ③	0	0	X
12 1 a m	29 a m	SDI a,m	Store Double (Indirect)	$(R_a, R_{a+1}) \rightarrow Y^*, Y^*+1$ ③	– NC –		
12 2 a m	2A a m	LRD a,y,m	Logical Right Double shift (Register)	Shift (R_a, R_{a+1}) right Y_{5-0} places, zero fill	0	0	X
12 3 a m	2B a m	SD a,y,m	Store Double	$(R_a, R_{a+1}) \rightarrow Y, Y+1$ ③	– NC –		

Optional Math Pac Instructions ① Count = 31 for all zeros or all ones. ② if a ≠ m ③ a,m,y must be even
④ if a+1 ≠ m ⑤ cc set on Ra+1 only ⑥ if Class II interrupts enabled

OCTAL FORMAT o f a m	HEXIDECIMAL FORMAT OP a m	CODING FORMAT	INSTRUCTION	OPERATION	C	OV	CC
13 0 a m	2C a m	ARDR a,m	Algebraic Right Double shift	Shift (R_a, R_{a+1}) right $(R_m)_{5-0}$ places, sign fill	0	0	X
13 2 a m	2E a m	ARD a,y,m	Algebraic Right Double shift	Shift (R_a, R_{a+1}) right Y_{5-0} places, sign fill ③	0	0	X
13 3 a m	2F a m	SM a,y,m	Store Multiple	$(R_a \ldots R_m) \rightarrow Y \ldots Y+m-a$	–	NC	–
14 0 a m	30 a m	ALSR a,m	Algebraic Left shift (Register)	Shift (R_a) left $(R_m)_{5-0}$ places, zero fill	0	X	X
14 2 a m	32 a m	ALS a,y,m	Algebraic Left shift	Shift (R_a) left Y_{5-0} places, zero fill	0	X	X
14 3 a m	33 a m	BSX a,y,m	Byte Store, index by 1	$(R_a)_{7-0} \rightarrow Y_{byte}$; $(R_m)+1 \rightarrow R_m$	–	NC	–
15 0 a m	34 a m	CLSR a,m	Circular Left shift (Register)	Shift (R_a) circularly left $(R_m)_{5-0}$ places	0	0	X
15 1 a m	35 a m	SXI a,m	Store index by 1 (Indirect)	$(R_a) \rightarrow Y^*$; $(R_m)+1 \rightarrow R_m$	–	NC	–
15 2 a m	36 a m	CLS a,y,m	Circular Left shift	Shift (R_a) circularly left Y_{5-0} places	0	0	X
15 3 a m	37 a m	SX a,y,m	Store, index by 1	$(R_a) \rightarrow Y$; $(R_m)+1 \rightarrow R_m$	–	NC	–
16 0 a m	38 a m	ALDR a,m	Algebraic Left Double shift (Register)	Shift (R_a, R_{a+1}) left $(R_m)_{5-0}$ places, zero fill ③	0	X	X
16 1 a m	39 a m	SDXI a,m	Store Double index by 2 (Indirect)	$(R_a, R_{a+1}) \rightarrow Y^*, Y^*+1$; $(R_m)+2 \rightarrow R_m$ ② ③	–	NC	–
16 2 a m	3A a m	ALD a,y,m	Algebraic Left Double shift	Shift (R_a, R_{a+1}) left Y_{5-0} places zero fill ③	0	X	X
16 3 a m	3B a m	SDX a,y,m	Store Double, index by 2	$(R_a, R_{a+1}) \rightarrow (Y, Y+1)$; $(R_m)+2 \rightarrow R_m$ ② ③	–	NC	–
17 0 a m	3C a m	CLDR a,m	Circular Left Double shift (Register)	Shift (R_a, R_{a+1}) circularly left $(R_m)_{5-0}$ places ③	0	0	X
17 1 00 m	3D 0 m	SZI m	Store Zeros (Indirect)	$0 \rightarrow Y^*$	–	NC	–
17 2 a m	3E a m	CLD a,y,m	Circular Left Double shift	Shift (R_a, R_{a+1}) circularly left Y_{5-0} places ③	0	0	X
17 3 00 m	3F 0 m	SZ y,m	Store Zeros	$0 \rightarrow Y$	–	NC	–
20 0 a m	40 a m	SUR a,m	Subtract (Register)	$(R_a) - (R_m) \rightarrow R_a$	X	X	X
20 1 a m	41 a m	SUI a,m	Subtract (Indirect)	$(R_a) - (Y^*) \rightarrow R_a$	X	X	X
20 2 a m	42 a m	SUK a,y,m	Subtract (Constant)	$(R_a) - Y \rightarrow R_a$	X	X	X
20 3 a m	43 a m	SU a,y,m	Subtract	$(R_a) - (Y) \rightarrow R_a$	X	X	X
21 0 a m	44 a m	SUDR a,m	Subtract Double (Register)	$(R_a, R_{a+1}) - (R_m, R_{m+1}) \rightarrow R_a, R_{a+1}$	X	X	X
21 1 a m	45 a m	SUDI a,m	Subtract Double (Indirect)	$(R_a, R_{a+1}) - (Y^*, Y^*+1) \rightarrow R_a, R_{a+1}$	X	X	X
21 3 a m	47 a m	SUD a,y,m	Subtract Double	$(R_a, R_{a+1}) - (Y, Y+1) \rightarrow R_a, R_{a+1}$ ③	X	X	X
22 0 a m	48 a m	AR a,m	Add (Register)	$(R_a) + (R_m) \rightarrow R_a$	X	X	X
22 1 a m	49 a m	AI a,m	Add (Indirect)	$(R_a) + (Y^*) \rightarrow R_a$	X	X	X
22 2 a m	4A a m	AK a,y,m	Add (Constant)	$(R_a) + Y \rightarrow R_a$	X	X	X
22 3 a m	4B a m	A a,y,m	Add	$(R_a) + (Y) \rightarrow R_a$	X	X	X
23 0 a m	4C a m	ADR a,m	Add Double (Register)	$(R_a, R_{a+1}) + (R_m, R_{m+1}) \rightarrow R_a, R_{a+1}$	X	X	X
23 1 a m	4D a m	ADI a,m	Add Double (Indirect)	$(R_a, R_{a+1}) + (Y^*, Y^*+1) \rightarrow R_a, R_{a+1}$ ③	X	X	X
23 3 a m	4F a m	AD a,y,m	Add Double	$(R_a, R_{a+1}) + (Y, Y+1) \rightarrow R_a, R_{a+1}$ ③	X	X	X
24 0 a m	50 a m	CR a,m	Compare (Register)	(R_a): (R_m)	X	X	X
24 1 a m	51 a m	CI a,m	Compare (Indirect)	(R_a): (Y^*)	X	X	X
24 2 a m	52 a m	CK a,y,m	Compare (Constant)	(R_a): Y	X	X	X
24 3 a m	53 a m	C a,y,m	Compare	(R_a): (Y)	X	X	X
25 0 a m	54 a m	CDR a,m	Compare Double (Register)	(R_a, R_{a+1}): (R_m, R_{m+1}) ③	X	X	X
25 1 a m	55 a m	CDI a,m	Compare Double (Indirect)	(R_a, R_{a+1}): (Y^*, Y^*+1) ③	X	X	X
25 3 a m	57 a m	CD a,y,m	Compare Double	(R_a, R_{a+1}): $(Y, Y+1)$ ③	X	X	X
26 0 a m	58 a m	MR a,m	Multiply (Register)	$(R_{a+1}) \cdot (R_m) \rightarrow R_a, R_{a+1}$ ③	0	0	X
26 1 a m	59 a m	MI a,m	Multiply (Indirect)	$(R_{a+1}) \cdot (Y^*) \rightarrow R_a, R_{a+1}$ ③	0	0	X
26 2 a m	5A a m	MK a,y,m	Multiply (Constant)	$(R_{a+1}) \cdot Y \rightarrow R_a, R_{a+1}$ ③	0	0	X
26 3 a m	5B a m	M a,y,m	Multiply	$(R_{a+1}) \cdot (Y) \rightarrow R_a, R_{a+1}$ ③	0	0	X
27 0 a m	5C a m	DR a,m	Divide (Register)	$(R_a, R_{a+1}) / (R_m) \rightarrow R_{a+1}$; remainder $\rightarrow R_a$ ③	X	X	X
27 1 a m	5D a m	DI a,m	Divide (Indirect)	$(R_a, R_{a+1}) / (Y^*) \rightarrow R_{a+1}$; remainder $\rightarrow R_a$	X	X	X
27 2 a m	5E a m	DK a,y,m	Divide (Constant)	$(R_a, R_{a+1}) / Y \rightarrow R_{a+1}$; remainder $\rightarrow R_a$ ③	X	X	X
27 3 a m	5F a m	D a,y,m	Divide	$(R_a, R_{a+1}) / (Y) \rightarrow R_{a+1}$; remainder $\rightarrow R_a$ ③	X	X	X
30 0 a m	60 a m	ANDR a,m	AND (Register)	$(R_a) \wedge (R_m) \rightarrow R_a$	0	0	X
30 1 a m	61 a m	ANDI a,m	AND (Indirect)	$(R_a) \wedge (Y^*) \rightarrow R_a$	0	0	X
30 2 a m	62 a m	ANDK a,y,m	AND (Constant)	$(R_a) \wedge Y \rightarrow R_a$	0	0	X
30 3 a m	63 a m	AND a,y,m	AND	$(R_a) \wedge (Y) \rightarrow R_a$	0	0	X
31 0 a m	64 a m	ORR a,m	OR (Register)	$(R_a) \vee (R_m) \rightarrow R_a$	0	0	X
31 1 a m	65 a m	ORI a,m	OR (Indirect)	$(R_a) \vee (Y^*) \rightarrow R_a$	0	0	X
31 2 a m	66 a m	ORK a,y,m	OR (Constant)	$(R_a) \vee Y \rightarrow R_a$	0	0	X
31 3 a m	67 a m	OR a,y,m	OR	$(R_a) \vee (Y) \rightarrow R_a$	0	0	X
32 0 a m	68 a m	XORR a,m	Exclusive OR (Register)	$(R_a) \forall (R_m) \rightarrow R_a$	0	0	X
32 1 a m	69 a m	XORI a,m	Exclusive OR (Indirect)	$(R_a) \forall (Y^*) \rightarrow R_a$	0	0	X
32 2 a m	6A a m	XORK a,y,m	Exclusive OR (Constant)	$(R_a) \forall Y \rightarrow R_a$	0	0	X
32 3 a m	6B a m	XOR a,y,m	Exclusive OR	$(R_a) \forall (Y) \rightarrow R_a$	0	0	X
33 0 a m	6C a m	MSR a,m	Masked Substitute (Register)	If $(R_{a+1})_n=1$; $(R_m)_n \rightarrow R_{an}$ ③	0	0	X
33 1 a m	6D a m	MSI a,m	Masked Substitute (Indirect)	If $(R_{a+1})_n=1$; $(Y^*)_n \rightarrow R_{an}$ ③	0	0	X
33 2 a m	6E a m	MSK a,y,m	Masked Substitute (Constant)	If $(R_{a+1})_n=1$; $Y_n \rightarrow R_{an}$ ③	0	0	X
33 3 a m	6F a m	MS a,y,m	Masked Substitute	If $(R_{a+1})_n = 1$; $(Y)_n \rightarrow R_{an}$ ③	0	0	X
34 0 a m	70 a m	CMR a,m	Compare Masked (Register)	$[(R_a) \wedge (R_{a+1})]$: $[(R_m) \wedge (R_{a+1})]$ ③	0	0	X

② if a ≠ m ③ a,m,y must be even

OCTAL FORMAT o	f	a	m	HEXIDECIMAL FORMAT OP	a	m	CODING FORMAT	INSTRUCTION	OPERATION	C	OV	CC
34	1	a	m	71	a	m	CMI a,m	Compare Masked (Indirect)	$[(R_a) \wedge (R_{a+1})] : [(Y^*) \wedge (R_{a+1})]$ ③	0	0	X
34	2	a	m	72	a	m	CMK a,y,m	Compare Masked (Constant)	$[(R_a) \wedge (R_{a+1})] : [Y \wedge (R_{a+1})]$ ③	0	0	X
34	3	a	m	73	a	m	CM a,y,m	Compare Masked	$[(R_a) \wedge (R_{a+1})] : [(Y) \wedge (R_{a+1})]$ ③	0	0	X
35	0	00	00	74	0	0	IOCR	Input/Output Command	Execute (0140); $0 \rightarrow 0140_{15,14}$	– NC –		
35	1	00	m	75	0	m	BFI m	Biased Fetch (Indirect)	$(Y^*) \rightarrow CC$; $1 \rightarrow Y^*_{15,14}$	0	0	X
35	2	00	m	76	0	m	REX y,m	Remote Execute	Execute (Y); (P) + 2 → P	– NA –		
35	3	00	m	77	0	m	BF y,m	Biased Fetch	$(Y) \rightarrow CC$; $1 \rightarrow Y_{15,14}$	0	0	X
#37	0	a	m	7C	a	0	See page 6	Trig & Hyperbolic		– NC –		
#37	0	a	010	7C	a	10	FC a,y	Floating Point Compare	(Ra, Ra+1): (Y, Y+1) ⑦ ⑧	0	0	X
#37	0	a	011	7C	a	11	FXC a	Fixed to Floating Point Conversion	Form normalized Floating Point number in Ra, Ra+1, from the binary exponent in R_a and integer mantissa in R_{a+1} (2's complement)	X	X	X
#37	0	a	012	7C	a	12	FLC a	Floating Point to Fixed Conversion	Unpack Floating Point number in R_a, R_{a+1} into binary exponent in R_a and integer mantissa into R_{a+1}	0	0	X
#37	0	a	013	7C	a	13	NF a	Floating Point Normalize	Normalize the Floating Point number in R_a and R_{a+1}	X	X	X
#37	0	a	016	7C	a	16	QAL a y	Algebraic Left Quadruple Shift	Shift (R_a, R_{a+1}, R_{a+2}, R_{a+3}) Left Y_{5-0} places, zero fill ⑦	0	X	X
#37	0	a	017	7C	a	17	QAR a,y	Algebraic Right Quadruple Shift	Shift (R_a, R_{a+1}, R_{a+2}, R_{a+3}) Right Y_{5-0} places, sign fill ⑦	0	0	X
40	0	00	m	80	0	m	JER m	Jump Equal	If CC indicates = or 0; $(R_m) \rightarrow P$	– NC –		
40	0	01	m	80	1	m	JNER m	Jump Not Equal	If CC indicates ≠ or not 0; $(R_m) \rightarrow P$	– NC –		
40	0	02	m	80	2	m	JGER m	Jump Greater or Equal	If CC indicates ≥ or +; $(R_m) \rightarrow P$	– NC –		
40	0	03	m	80	3	m	JLSR m	Jump Less	If CC indicates < or -; $(R_m) \rightarrow P$	– NC –		
40	0	04	m	80	4	m	JOR m	Jump Overflow	If overflow set: $(R_m) \rightarrow P$	– NC –		
40	0	05	m	80	5	m	JCR m	Jump Carry	If carry set: $(R_m) \rightarrow P$	– NC –		
40	0	06	m	80	6	m	JPTR m	Jump Power out of Tolerance	If power out of tolerance: $(R_m) \rightarrow P$	– NC –		
40	0	07	m	80	7	m	JBR m	Jump Bootstrap 2 selected	If bootstrap 2 selected: $(R_m) \rightarrow P$	– NC –		
40	0	10	m	80	8	m	JR m	Jump	$(R_m) \rightarrow P$	– NC –		
40	0	11	m	80	9	m	JSR m	Jump after Stop	Stop; $(R_m) \rightarrow P$	– NC –		
40	0	12	m	80	A	m	JKSR 1,m	Jump. If Key set–Stop, then jump (Register)	If key 1 set, stop; $(R_m) \rightarrow P$	– NC –		
40	0	13	m	80	B	m	JKSR 2,m	Jump. If Key set–Stop, then jump (Register)	If key 2 set, stop; $(R_m) \rightarrow P$	– NC –		
40	1		d	81		d	LJ xD	Local Jump	(P) + D → P	– NC –		
40	2	00	m	82	0	m	JE y,m	Jump Equal	If CC indicates = or 0; Y → P	– NC –		
40	2	01	m	82	1	m	JNE y,m	Jump Not Equal	If CC indicates ≠ or not 0; Y → P	– NC –		
40	2	02	m	82	2	m	JGE y,m	Jump Greater than or Equal	If CC indicates ≥ or +; Y → P	– NC –		
40	2	03	m	82	3	m	JLS y,m	Jump Less	If CC indicates < or -; Y → P	– NC –		
40	2	04	m	82	4	m	JO y,m	Jump on Overflow	If overflow set: Y → P	– NC –		
40	2	05	m	82	5	m	JC y,m	Jump on Carry	If carry set, Y → P	– NC –		
40	2	06	m	82	6	m	JPT y,m	Jump if Power out of Tolerance	If power out of tolerance; Y → P	– NC –		
40	2	07	m	82	7	m	JB y,m	Jump if Bootstrap 2 selected	If bootstrap 2 selected; Y → P	– NC –		
40	2	10	m	82	8	m	J y,m	Jump	Y → P	– NC –		
40	2	11	m	82	9	m	JS y,m	Jump after Stop	Stop; Y → P	– NC –		
40	2	12	m	82	A	m	JKS 1,y,m	Jump. If Key set–Stop, then jump	If key 1 set, stop; Y → P	– NC –		
40	2	13	m	82	B	m	JKS 2,y,m	Jump. If Key set–Stop, then jump	If key 2 set, stop; Y → P	– NC –		
40	3	00	m	83	0	m	JE *y,m	Jump Equal	If CC indicates = or 0; (Y) → P	– NC –		
40	3	01	m	83	1	m	JNE *y,m	Jump Not Equal	If CC indicates ≠ or not 0; (Y) → P	– NC –		
40	3	02	m	83	2	m	JGE *y,m	Jump Greater or Equal	If CC indicates ≥ or +; (Y) → P	– NC –		
40	3	03	m	83	3	m	JLS *y,m	Jump Less	If CC indicates < or -; (Y) → P	– NC –		
40	3	04	m	83	4	m	JO *y,m	Jump on Overflow	If overflow set; (Y) → P	– NC –		
40	3	05	m	83	5	m	JC *y,m	Jump on Carry	If carry set; (Y) → P	– NC –		
40	3	06	m	83	6	m	JPT *y,m	Jump if Power out of Tolerance	If power out of tolerance; (Y) → P	– NC –		
40	3	07	m	83	7	m	JB *y,m	Jump if Bootstrap 2 selected	If bootstrap 2 selected; (Y) → P	– NC –		
40	3	10	m	83	8	m	J *y,m	Jump	(Y) → P	– NC –		
40	3	11	m	83	9	m	JS *y,m	Jump After Stop	Stop; (Y) → P	– NC –		
40	3	12	m	83	A	m	JKS 1,*y,m	Jump. If Key set–Stop, then jump	If key 1 set, stop; (Y) → P	– NC –		
40	3	13	m	83	B	m	JKS 2,*y,m	Jump. If Key set–Stop, then jump	If key 2 set, stop; (Y) → P	– NC –		
41	0	a	m	84	a	m	XJR a,m	Index Jump Register	If $(R_a) \neq 0$; $(R_a) - 1 \rightarrow R_a$, $(R_m) \rightarrow P$	– NC –		
41	1		d	85		d	LJI xD	Local Jump (Indirect)	[(P) + D] → P	– NC –		
41	2	a	m	86	a	m	XJ a,y,m	Index Jump	If $(R_a) \neq 0$; $(R_a) - 1 \rightarrow R_a$; Y → P	– NC –		
41	3	a	m	87	a	m	XJ a,*y,m	Index Jump	If $(R_a) \neq 0$; $(R_a) - 1 \rightarrow R_a$; (Y) → P	– NC –		

Optional Math Pac Instruction

③ a,m,y must be even ⑦ cannot be executed via execute remote ⑧ operands must be normalized

OCTAL FORMAT o f a m	HEXIDECIMAL FORMAT OP a m	CODING FORMAT	INSTRUCTION	OPERATION	C	OV	CC
42 0 a m	88 a m	JLRR a,m	Jump, Link Register (Register)	(P) + 1 → R_a, (R_m) → P		– NC –	
42 2 a m	8A a m	JLR a,y,m	Jump, Link Register	(P) + 2 → R_a, Y → P		– NC –	
42 3 a m	8B a m	JLR a,*y,m	Jump, Link Register	(P) + 2 → R_a, (Y) → P		– NC –	
43 1 d	8D d	LJLM xD	Local Jump, Link Memory	(P) + 1 → (P) + D; (P) + D + 1 → P		– NC –	
43 2 00 m	8E 0 m	JLM y,m	Jump, Link Memory	(P) + 2 → Y; Y + 1 → P		– NC –	
43 3 00 m	8F 0 m	JLM *y,m	Jump, Link Memory	(P) + 2 → (Y); (Y) + 1 → P		– NC –	
44 0 a m	90 a m	JZR a,m	Jump Zero (Register)	If (R_a) = 0; (R_m) → P		– NC –	
44 1 d	91 d	LJE xD	Local Jump Equal	If CC indicates = or 0; (P) + D → P		– NC –	
44 2 a m	92 a m	JZ a,y,m	Jump Zero	If (R_a) = 0; Y → P		– NC –	
44 3 a m	93 a m	JZ a,*y,m	Jump Zero	If (R_a) = 0; (Y) → P		– NC –	
45 0 a m	94 a m	JNZR a,m	Jump Not Zero (Register)	If (R_a) ≠ 0; (R_m) → P		– NC –	
45 1 d	95 d	LJNE xD	Local Jump Not Equal	If CC indicates ≠ or not 0; (P) + D → P		– NC –	
45 2 a m	96 a m	JNZ a,y,m	Jump Not Zero	If (R_a) ≠ 0; Y → P		– NC –	
45 3 a m	97 a m	JNZ a,*y,m	Jump Not Zero	If (R_a) ≠ 0; (Y) → P		– NC –	
46 0 a m	98 a m	JPR a,m	Jump Positive (Register)	If (R_a) ≥ 0; (R_m) → P		– NC –	
46 1 d	99 d	LJGE xD	Local Jump Greater or Equal	If CC indicates ≥ or +; (P) + D → P		– NC –	
46 2 a m	9A a m	JP a,y,m	Jump Positive	If (R_a) ≥ 0; Y → P		– NC –	
46 3 a m	9B a m	JP a,*y,m	Jump Positive	If (R_a) ≥ 0; (Y) → P		– NC –	
47 0 a m	9C a m	JNR a,m	Jump Negative (Register)	If (R_a) < 0; (R_m) → P		– NC –	
47 1 d	9D d	LJLS xD	Local Jump Less	If CC indicates < or -; (P) + D → P		– NC –	
47 2 a m	9E a m	JN a,y,m	Jump Negative	If (R_a) < 0; Y → P		– NC –	
47 3 a m	9F a m	JN a,*y,m	Jump Negative	If (R_a) < 0; (Y) → P		– NC –	
# 50 0 a m	A0 a m	FSUR a,m	Floating point subtract (Register)	(R_a, R_{a+1}) - (R_m, R_{m+1}) → R_a, R_{a+1}; Res. → R_{a+2}, R_{a+3}	X	X	X
# 50 1 a m	A1 a m	FSUI a,m	Floating point Subtract (Indirect)	(R_a, R_{a+1}) - (Y*, Y*+1) → R_a, R_{a+1}; Res. → R_{a+2}, R_{a+3}	X	X	X
# 50 3 a m	A3 a m	FSU a,y,m	Floating point Subtract	(R_a, R_{a+1}) - (Y, Y+1) → R_a, R_{a+1}; Res. → R_{a+2}, R_{a+3}	X	X	X
# 51 0 a m	A4 a m	FAR a,m	Floating point Add (Register)	(R_a, R_{a+1}) + (R_m, R_{m+1}) → R_a, R_{a+1}; Res. → R_{a+2}, R_{a+3}	X	X	X
# 51 1 a m	A5 a m	FAI a,m	Floating point Add (Indirect)	(R_a, R_{a+1}) + (Y*, Y*+1) → R_a, R_{a+1}; Res. → R_{a+2}, R_{a+3} ③	X	X	X
# 51 3 a m	A7 a m	FA a,y,m	Floating point Add	(R_a, R_{a+1}) + (Y, Y+1) → R_a, R_{a+1}; Res. → R_{a+2}, R_{a+3}	X	X	X
# 52 0 a m	A8 a m	FMR a,m	Floating point Multiply (Register)	(R_a, R_{a+1}) · (R_m, R_{m+1}) → R_a, R_{a+1}; Res. → R_{a+2}, R_{a+3}	X	X	X
# 52 1 a m	A9 a m	FMI a,m	Floating point Multiply (Indirect)	(R_a, R_{a+1}) · (Y*, Y*+1) → R_a, R_{a+1}; Res. → R_{a+2}, R_{a+3}	X	X	X
# 52 3 a m	AB a m	FM a,y,m	Floating point Multiply	(R_a, R_{a+1}) · (Y, Y+1) → R_a, R_{a+1}, Res. → R_{a+2}, R_{a+3}	X	X	X
# 53 0 a m	AC a m	FDR a,m	Floating point Divide (Register)	(R_a, R_{a+1}) / (R_m, R_{m+1}) → R_a, R_{a+1}; Rem. → R_{a+2}, R_{a+3}	X	X	X
# 53 1 a m	AD a m	FDI a,m	Floating point Divide (Indirect)	(R_a, R_{a+1}) / (Y*, Y*+1) → R_a, R_{a+1}; Rem. → R_{a+2}, R_{a+3}	X	X	X
# 53 3 a m	AF a m	FD a,y,m	Floating point Divide	(R_a, R_{a+1}) / (Y, Y+1) → R_a, R_{a+1}; Rem. → R_{a+2}, R_{a+3}	X	X	X
54 0 a m	B0 a m	LARR a,m	Load Address Register (Register)	(R_m) → AR_r SEE LEGEND		– NC –	
54 1 a m	B1 a m	LARI a,m	Load Address Register (Indirect)	(Y*) → AR_r		– NC –	
54 3 a m	B3 a m	LARM a,y,m	Load Address Register Multiple	(Y, ... Y + u) → AR_r, ... AR_{r+u}		– NC –	
55 0 a m	B4 a m	SARR a,m	Store Address Register (Register)	(AR_r) → R_m		– NC –	
55 1 a m	B5 a m	SARI a,m	Store Address Register (Indirect)	(AR_r) → Y*		– NC –	
55 3 a m	B7 a m	SARM a,y,m	Store Address Register Multiple	(AR_r, . . . AR_{r+u}) → Y, . . . Y + u		– NC –	
# 56 0 a m	B8 a m	MDR a,m	Multiply Double (Register)	(R_a, R_{a+1}) · (R_m, R_{m+1}) → R_a, R_{a+1}, R_{a+2}, R_{a+3} ③	0	0	X
# 56 1 a m	B9 a m	MDI a,m	Multiply Double (Indirect)	(R_a, R_{a+1}) · (Y*, Y*+1) → R_a, R_{a+1}, R_a + 2, R_a + 3 ③	0	0	X
# 56 3 a m	BB a m	MD a,y,m	Multiply Double	(R_a, R_{a+1}) · (Y, Y+1) → R_a, R_{a+1}, R_{a+2}, R_{a+3} ③	0	0	X
# 57 0 a m	BC a m	DDR a,m	Divide Double (Register)	(R_a, R_{a+1}, R_{a+2}, R_{a+3}) / (R_m, R_{m+1}) → R_{a+2}, R_{a+3}; Rem. → R_a, R_{a+1} ③	0	X	X
# 57 1 a m	BD a m	DDI a,m	Divide Double (Indirect)	(R_a, R_{a+1}, R_{a+2}, R_{a+3}) / (Y*, Y*+1) → R_{a+2}, R_{a+3}; Rem. → R_a, R_{a+1} ③	0	X	X
# 57 3 a m	BF a m	DD a,y,m	Divide Double	(R_a, R_{a+1}, R_{a+2}, R_{a+3}) / (Y, Y+1) → R_{a+2}, R_{a+3}; Rem. → R_a, R_{a+1} ③	0	X	X
60 0 a m	C0 a m	LLRS a,m	Literal Logical Right Shift	Shift (R_a) right m places, zero fill	0	0	X
60 1 a m	C1 a m	LARS a,m	Literal Algebraic Right Shift	Shift (R_a) right m places, sign fill	0	0	X
60 2 a m	C2 a m	LLRD a,m	Literal Logical Right Double shift	Shift (R_a, R_{a+1}) right m places, zero fill ③	0	0	X

Optional Math Pac Instructions

③ a,m,y must be even

OCTAL FORMAT o f a m	HEXIDECIMAL FORMAT OP a m	CODING FORMAT	INSTRUCTION	OPERATION	C	OV	CC
60 3 a m	C3 a m	LARD a,m	Literal Algebraic Right Double shift	Shift (R_a, R_{a+1}) right m places, sign fill ③	0	0	X
61 0 a m	C4 a m	LALS a,m	Literal Algebraic Left Shift	Shift (R_a) left m places, zero fill	0	X	X
61 1 a m	C5 a m	LCLS a,m	Literal Circular Left Shift	Shift (R_a) left circular m places	0	0	X
61 2 a m	C6 a m	LALD a,m	Literal Algebraic Left Double shift	Shift (R_a, R_{a+1}) left m places, zero fill ③	0	X	X
61 3 a m	C7 a m	LCLD a,m	Literal Circular Left Double shift	Shift (R_a, R_{a+1}) left circular m places ③	0	0	X
62 0 a m	C8 a m	LSU a,m	Literal Subtract	$(R_a) - m \rightarrow R_a$	X	X	X
62 1 a m	C9 a m	LSUD a,m	Literal Subtract Double	$(R_a, R_{a+1}) - m \rightarrow R_a, R_{a+1}$ ③	X	X	X
62 2 a m	CA a m	LA a,m	Literal Add	$(R_a) + m \rightarrow R_a$	X	X	X
62 3 a m	CB a m	LAD a,m	Literal Add Double	$(R_a, R_{a+1}) + m \rightarrow R_a, R_{a+1}$ ③	X	X	X
63 0 a m	CC a m	LL a,m	Literal Load	$m \rightarrow R_a$	0	0	X
63 1 a m	CD a m	LC a,m	Literal Compare	$(R_a) : m$	X	X	X
63 2 a m	CE a m	LMUL a,m	Literal Multiply	$(R_{a+1}) \cdot m \rightarrow R_a, R_{a+1}$ ③	0	0	X
63 3 a m	CF a m	LDIV a,m	Literal Divide	$(R_a, R_{a+1}) / m \rightarrow R_{a+1}$, ③ remainder $\rightarrow R_a$	0	X	X
64 3 a m	D3 a m	BSU a,y,m	Byte Subtract	$(R_a) \quad (Y)_{byte} \rightarrow R_a$	X	X	X
65 3 a m	D7 a m	BA a,y,m	Byte Add	$(R_a) + (Y)_{byte} \rightarrow R_a$	X	X	X
66 3 a m	DB a m	BC a,y,m	Byte Compare	$(R_a) \quad (Y)_{byte}$	X	X	X
67 0 a m	DC a m	UM1 a,m UM2 a,m	User Macro – CP	Reserved for User Macro		-NA-	
67 1 a m	DD a m	UMI a,m	User Macro – CP	Reserved for User Macro		-NA-	
67 2 a m	DE a m	UMK a,y,m	User Macro – CP	Reserved for User Macro		-NA-	
67 3 a m	DF a m	BCX a,y,m	Byte Compare and Index By 1	$(R_a) : (Y)_{byte} \cdot (R_m) + 1 \rightarrow R_m$	X	X	X

COMMAND/CHAIN INSTRUCTION

70 0 00 00	E0 0 0	ACR 0 CCR 0,0	Channel Control	Master clear all channels
70 0 00 04	E0 0 4	ACR 4 CCR 0,4	Channel Control	Enable external interrupts, all channels
70 0 00 05	E0 0 5	ACR 5 CCR 0,5	Channel Control	Disable external interrupts, all channels
70 0 00 06	E0 0 6	ACR 6 CCR 0,6	Channel Control	Enable Class III, Priority 2, 3, 4 interrupts
70 0 00 07	E0 0 7	ACR 7 CCR 0,7	Channel Control	Disable Class III, Priority 2, 3, 4 interrupts
70 0 a 10	E0 a 8	CCR a,10	Channel Control	Master clear chan. a
70 0 a 14	E0 a C	CCR a,14	Channel Control	Enable chan. a external interrupts
70 0 a 15	E0 a D	CCR a,15	Channel Control	Disable chan. a external interrupts
70 0 a 16	E0 a E	CCR a,16	Channel Control	Enable chan. a Class III, Priority 2, 3, 4 interrupts
70 0 a 17	E0 a F	CCR a,17	Channel Control	Disable chan. a Class III, Priority 2, 3, 4 interrupts
72 0 a m			User Macro – I/O	Reserved for User Macro
72 1 a m			User Macro – I/O	Reserved for User Macro

COMMAND INSTRUCTION

71 2 a 02	E6 a 2	ICK a,y	Initiate Input Chain	Y - Channel a Chain Pointer; initiate input chain
71 2 a 06	E6 a 6	OCK a,y	Initiate Output Chain	Y - Channel a Chain Pointer; initiate output chain
71 3 a m	E7 a m	WIM a,y,m WCM am,y	Write Control Memory	(Y) - Chan. a CM_m (See Figure 6)
72 3 a m	EB a m	RIM a,y,m RCM am,y	Read Control Memory	Chan. a (CM_m) - Y (See Figure 6)
76 0 a m	F8 a m	SICR a,m	Serial Interface Control	Set or clear chan. a discrete function per Table 3
76 3 a m	FB a m	SST a,y	Store Serial Status	Channel a Serial Satus bits - Y (See Table 4)

CHAIN INSTRUCTION

70 3 00 00	E3 0 0	IO 0,y	Input Data	(Y, Y+1) - BCW, BAP; initiate transfer
70 3 01 00	E3 1 0	IO 1,y	Output Data	(Y, Y+1) - BCW, BAP; initiate transfer
70 3 02 00	E3 2 0	IO 2,y	External Function	(Y, Y+1) - BCW, BAP; initiate transfer
70 3 03 00	E3 3 0	IO 3,y	Force External Function	(Y, Y+1) - BCW, BAP; initiate transfer
71 2 00 m	E6 0 m	LCMK m,y	Load Control Memory	Y - CM_m (See Figure 6) { initiate input chain, m = 2 / initiate output chain, m = 6
71 3 00 m	E7 0 m	LCM m,y	Load Control Memory	(Y) - CM_m (See Figure 6)
72 3 00 m	EB 0 m	SCM m,y	Store Control Memory	(CM_m) - Y (See Figure 6)
73 0 00 00	EC 0 0	HCR	Halt Chain	Halt chaining
73 0 01 00	EC 1 0	IPR	Interrupt Processor	Generate chain interrupt
73 3 00 00	EF 0 0	ZF y	Zero Flag	0 - Y, 15,14
73 3 01 00	EF 1 0	SF y	Set Flag	1 - Y, 15,14
74 2 00 00	F2 0 0	SJMC 0,y	Serial Jump on Met Condition	Unconditional Y - CAP
74 2 01 00	F2 1 0	SJMC 1,y	Serial Jump on Met Condition	If suppress flag not set, Y - CAP
74 2 02 00	F2 2 0	SJMC 2,y	Serial Jump on Met Condition	If monitor flag set, Y - CAP
75 0 00 m	F4 0 m	SFSC m	Search For Sync	Perform function(s) assigned to m bits per Figure 7
76 0 00 m	F8 0 m	CSIR m	Serial Interface Control	Set or clear discrete function per Table 3
76 3 00 m	FB 0 m	CSST y	Store Serial Status	Serial Status bits - Y; See Table 4

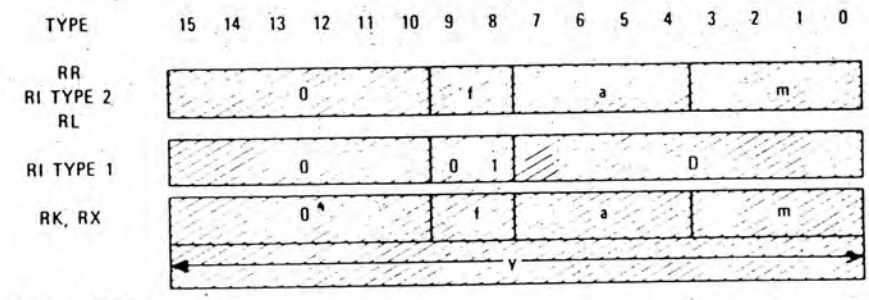
③ a,m,y must be even

TRIGONOMETRIC AND HYPERBOLIC FUNCTIONS
(Operation Code 37)

x&y	Cartesian coordinates. Radix point assumed to be the same
θ	Angle of rotation Trignonometric mode (BAMS) Bit 15 = 180°
v	Angle of rotation Hyperbolic mode Radix point assumed between bits 15 and 14
K	0.46672_8
K_1	1.15217_8

o f a m	CODING FORMAT	FUNCTION	INPUT PARAMETERS R_a	INPUT PARAMETERS R_{a+1}	INPUT PARAMETERS R_{a+2}	OUTPUT RESULTS $Y \rightarrow R_a$	OUTPUT RESULTS $X \rightarrow R_{a+1}$	OUTPUT RESULTS $W \rightarrow R_{a+2}$
37 0 a 00	VF a	Trigonometric vector	y	x	0	0	$X = \frac{R}{K} \pm \frac{\sqrt{x^2+y^2}}{K}$	$W = \theta = \tan^{-1}\frac{y}{x}$
37 0 a 01	RF a	Trigonometric rotate	y	x	θ	$Y = \frac{y\cos\theta + x\sin\theta}{K}$	$X = \frac{x\cos\theta - y\sin\theta}{K}$	0
37 0 a 02	VFP a	Trig. vector with prescale	y	x	0	0	$X = R \pm \sqrt{x^2+y^2}$	$W = \theta = \tan^{-1}\frac{y}{x}$
37 0 a 03	RFP a	Trig. rotate with prescale	y	x	θ	$Y = y\cos\theta + x\sin\theta$	$X = x\cos\theta - y\sin\theta$	0
37 0 a 04	VH a	Hyperbolic vector	y	x	0	0	$X = \frac{\sqrt{x^2-y^2}}{K_1}$	$W = v = \tanh^{-1}\frac{y}{x}$
37 0 a 05	RH a	Hyperbolic rotate	y	x	v	$Y = \frac{y\cosh v + x\sinh v}{K_1}$	$X = \frac{x\cosh v + y\sinh v}{K_1}$	0
37 0 a 06	VHP a	Hyp. vector with postscale	y	x	0	0	$X \pm \sqrt{x^2-y^2}$	$W = v = \tanh^{-1}\frac{y}{x}$
37 0 a 07	RHP a	Hyp. rotate with postscale	y	x	v	$Y = y\cosh v + x\sinh v$	$X = x\cosh y + y\sinh v$	0
37 0 a 01	RF a	Sin θ; Cos θ	0	0.46672_8	θ	$Y = \sin\theta$	$X = \cos\theta$	0
37 0 a 03	RFP a	Sin θ; Cos θ	0	1	θ	$Y = \sin\theta$	$X = \cos\theta$	0
37 0 a 01	RF a	Polar to Cartesian without prescale	0	R	θ	$Y = \frac{R\sin\theta}{K}$	$X = \frac{R\cos\theta}{K}$	0
37 0 a 03	RFP a	Polar to Cartesian with prescale	0	R	θ	$Y = R\sin\theta$	$X = R\cos\theta$	0
37 0 a 06	VHP a	$\text{Log}_e x$	x−1	x+1	0	0	$2\sqrt{x}$	$W = 1/2\log_e x$ $= \tanh^{-1}\frac{x-1}{x+1}$
37 0 a 07	RHP a	Exponential	1	1	v	$Y = e^v = \cosh v + \sinh v$	$X = e^v = \cosh v + \sinh v$	0

Optional Math Pac Instructions

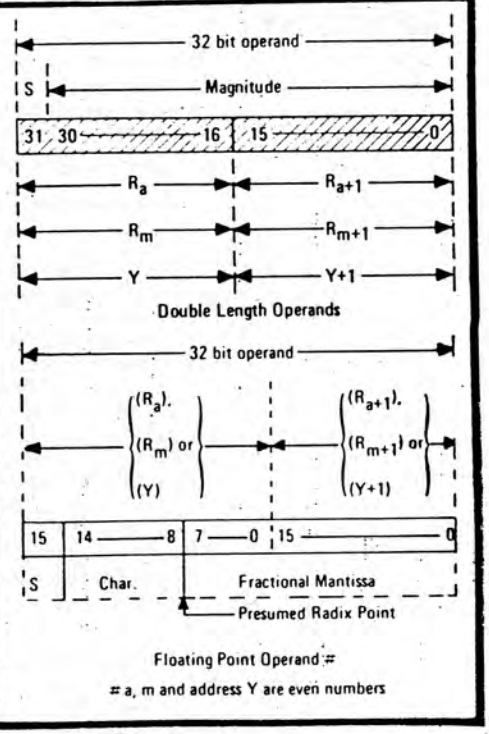


DEFINITION OF FIELDS

- 0 Operation (Function) Code
- f Format Designator
  - 00 ⇒ Format RR, Register to Register or RL-1 Format
  - 01 ⇒ Format RI, Register Indirect Memory or RL-2 Format
  - 10 ⇒ Format RK, Register-Literal Constant or RL-3 Format
  - 11 ⇒ Format RX, Register-Indexed Address, Constant or RL-4 Format
- a General Register or Subfunction Designator
- m General Register or Subfunction Designator
  4-bit Unsigned Literal Constant in RL Format
- D Signed Deviation Value (Two's Complement)
- y Address or Arithmetic Constant

Figure 1. Instruction Word Format

FORMAT	OPERAND FORMATION
RR	Operand = (R_m)
RI-1	Local Jump Address Y = (P) + xD
RI-2	Operand at Y* = (R_m)
RK	Operand Y = y + (R_m) if m ≠ 0
	Operand Y = y if m = 0
RX Word	Operand at Y = y if m = 0
	Operand at Y = y + (R_m) if m ≠ 0,10,12,14,16
	Operand at indirect address if m = 10,12,14,16
RX Byte	Operand at Y upper if m = 0
	Operand at Y = $(R_m)/2$ + y if m ≠ 0,10,12,14, 16; B = $(R_m)_0$
	Operand at indirect address if m = 10,12,14,16
RL	Operand = m (an absolute literal)



LEGEND

- B Byte pointer, 0 → Upper, 1 → Lower
- C Carry
- CC Condition Code
- OV Overflow
- IW Indirect Word
- j Designator Field in IW
- x General Register Designator in IW1
- y Contents of Second Instruction Word or IW2
- Y Effective Operand Address or Constant
- Y* Effective Operand Address in Rm
- TM I/O Transfer Mode
  - 00 → Abort Input Transfer
  - 01 → 8-bit Byte Transfer
  - 10 → 16-bit Word Transfer
  - 11 → 32-bit Dual Word Transfer
- BWC Buffer Word Count
- BAP Buffer Address Pointer
- CM Control Memory Word
- CAP Chain Address Pointer
- RTC Real-Time Clock
- ( ) Contents of register or address
- r $(R_a)_{5-0}$
- u $(R_a)_{13-8}$
- . 2's Complement
- : Compare

OR ∨	0	1
0	0	1
1	1	1

XOR ⊻	0	1
0	0	1
1	1	0

AND ∧	0	1
0	0	0
1	0	1

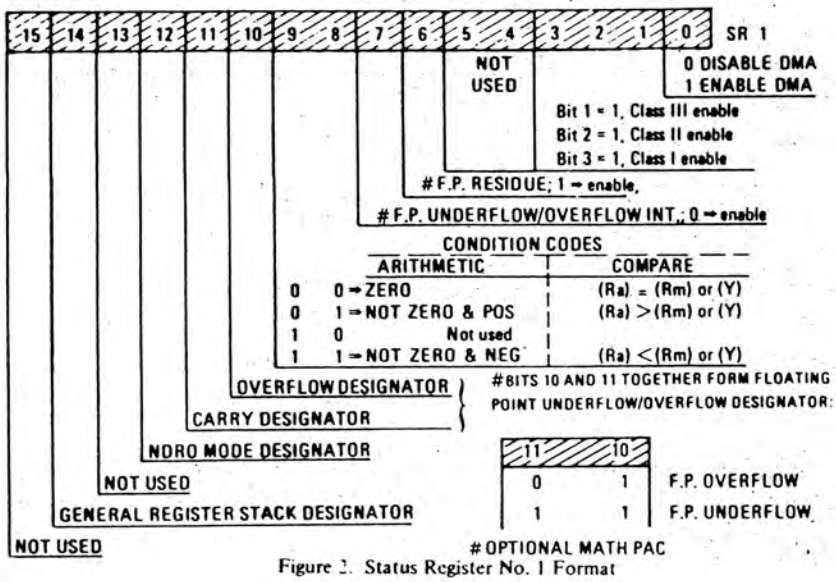

15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
SR 1
NOT USED
0 DISABLE DMA
1 ENABLE DMA
Bit 1 = 1, Class III enable
Bit 2 = 1, Class II enable
Bit 3 = 1, Class I enable
F.P. RESIDUE; 1 → enable,
F.P. UNDERFLOW/OVERFLOW INT.; 0 → enable
CONDITION CODES
ARITHMETIC
COMPARE
0 0 → ZERO
(Ra) = (Rm) or (Y)
0 1 → NOT ZERO & POS
(Ra) > (Rm) or (Y)
1 0 Not used
1 1 → NOT ZERO & NEG
(Ra) < (Rm) or (Y)
OVERFLOW DESIGNATOR
CARRY DESIGNATOR
#BITS 10 AND 11 TOGETHER FORM FLOATING POINT UNDERFLOW/OVERFLOW DESIGNATOR:
NORO MODE DESIGNATOR
NOT USED
GENERAL REGISTER STACK DESIGNATOR
NOT USED
11 10
0 1 F.P. OVERFLOW
1 1 F.P. UNDERFLOW
OPTIONAL MATH PAC

Figure 2. Status Register No. 1 Format

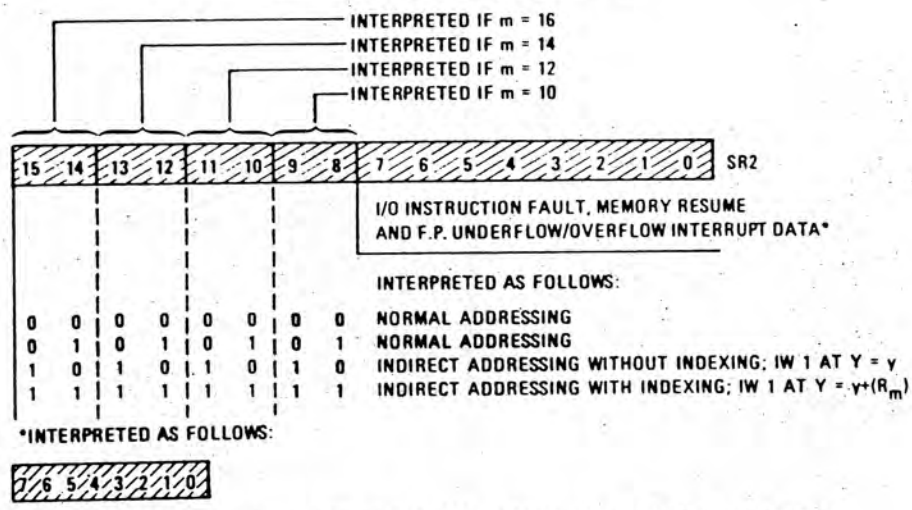

INTERPRETED IF m = 16
INTERPRETED IF m = 14
INTERPRETED IF m = 12
INTERPRETED IF m = 10
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
SR2
I/O INSTRUCTION FAULT, MEMORY RESUME
AND F.P. UNDERFLOW/OVERFLOW INTERRUPT DATA*
INTERPRETED AS FOLLOWS:
0 0 | 0 0 | 0 0 | 0 0 NORMAL ADDRESSING
0 1 | 0 1 | 0 1 | 0 1 NORMAL ADDRESSING
1 0 | 1 0 | 1 0 | 1 0 INDIRECT ADDRESSING WITHOUT INDEXING; IW 1 AT Y = y
1 1 | 1 1 | 1 1 | 1 1 INDIRECT ADDRESSING WITH INDEXING; IW 1 AT Y = y+(Rm)
*INTERPRETED AS FOLLOWS:
7 6 5 4 3 2 1 0
C C C C 0 X 1 0 CHAIN INSTRUCTION CCCC = CHAN #; X = 0 → INPUT; X = 1 → OUTPUT
0 0 0 0 0 0 0 1 COMMAND INSTRUCTION
1 M M M 0 0 1 0 MEMORY RESUME INTERRUPT; MMM = 8K MODULE NO.
IR 11-4 F.P. UNDERFLOW/OVERFLOW INTERRUPT

Figure 3. Status Register No. 2 Format

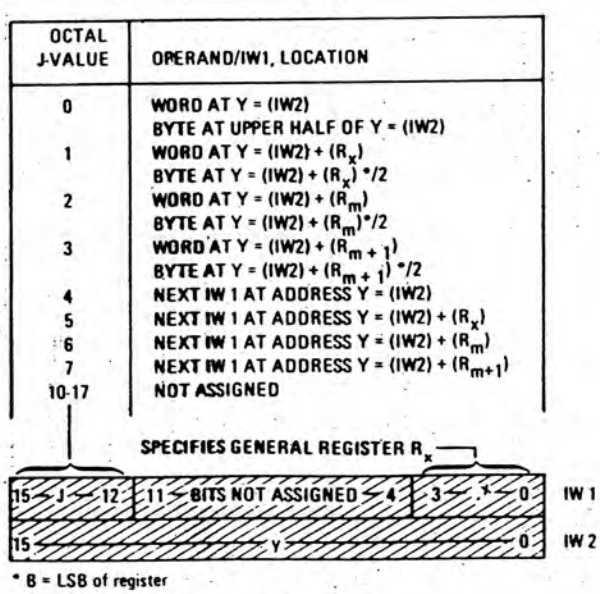

OCTAL J-VALUE
OPERAND/IW1, LOCATION
0
WORD AT Y = (IW2)
BYTE AT UPPER HALF OF Y = (IW2)
1
WORD AT Y = (IW2) + (Rx)
BYTE AT Y = (IW2) + (Rx) */2
2
WORD AT Y = (IW2) + (Rm)
BYTE AT Y = (IW2) + (Rm)*/2
3
WORD AT Y = (IW2) + (Rm + 1)
BYTE AT Y = (IW2) + (Rm + 1) */2
4
NEXT IW 1 AT ADDRESS Y = (IW2)
5
NEXT IW 1 AT ADDRESS Y = (IW2) + (Rx)
6
NEXT IW 1 AT ADDRESS Y = (IW2) + (Rm)
7
NEXT IW 1 AT ADDRESS Y = (IW2) + (Rm+1)
10-17
NOT ASSIGNED
SPECIFIES GENERAL REGISTER Rx
15 J 12 11 BITS NOT ASSIGNED 4 3 X 0 IW 1
15 Y 0 IW 2
* B = LSB of register

Figure 4. Indirect Addressing

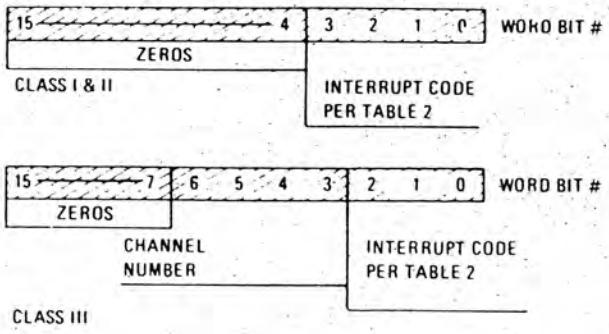


Figure 5. Interrupt Entrance Address Index

TABLE 1. ASSIGNED MEMORY ADDRESS

Function	Address Assignment to Class III	II	I
Store P addresses	110	120	130
Store SR # 1 addresses	111	121	131
Store SR # 2 addresses	112	122	132
Store RTC lower addresses	113	123	133
P Reload addresses	114	124	134
SR # 1 Reload addresses	115	125	135
SR # 2 Reload addresses	116	126	136
Store RTC upper addresses	117	127	137
I/O Command cells	140-141		
Auto start entrance	177		
External interrupt word storage	200-217		
NDRO	00-77, 300-477		

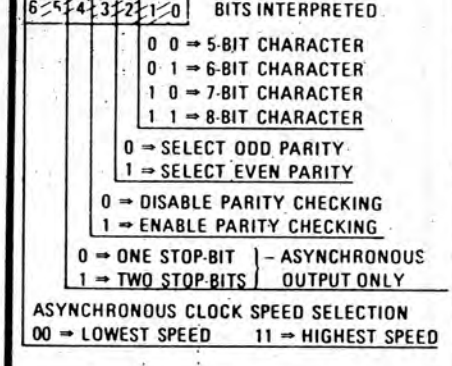
TABLE 2. INTERRUPT PRIORITY

Class	Priority Within Class	Interrupt	Binary Interrupt Code Generated
Class I, Hardware Errors	1	Power Fault	0000
	2	Memory Resume	0010
Class II, Software Interrupts	1	CP Instruction Fault	0000
	2	I/O Instruction Fault	0010
	3	#F.P. Overflow/Underflow Interrupt	0100
	4	Executive Return Instruction	0110
	5	RTC Overflow	1000
	6	Monitor Clock	1010
Class III, IOC Interrupts	1	Intercomputer Time-Out	110
	2	External Interrupt or Discrete Interrupt ①	000
	3	Output Chain Interrupt	100
	4	Input Chain Interrupt	010

① Serial MIL-STD-188C VACALES, or EIA-STD-RS-232C Channels # Optional Math Pac function

a-Value	m-Value	CONTROL MEMORY Register Selected
		15 14 13 12 11 0
	0	TM 0 B BWC (IN)
	1	BAP (IN)
	2	CAP (IN)
	3	Reserved
	4	TM 0 B BWC (OUT)
	5	BAP (OUT)
	6	CAP (OUT)
	7	Reserved
	10	Monitor register (Serial)
	11	Suppress register (Serial)
	12	Serial mode information*
	13-17	Reserved
0-17		Channel designator

*MIL-STD-188C or RS-232


6 5 4 3 2 1 0
BITS INTERPRETED
0 0 ⇒ 5-BIT CHARACTER
0 1 ⇒ 6-BIT CHARACTER
1 0 ⇒ 7-BIT CHARACTER
1 1 ⇒ 8-BIT CHARACTER
0 ⇒ SELECT ODD PARITY
1 ⇒ SELECT EVEN PARITY
0 ⇒ DISABLE PARITY CHECKING
1 ⇒ ENABLE PARITY CHECKING
0 ⇒ ONE STOP-BIT
1 ⇒ TWO STOP-BITS
ASYNCHRONOUS OUTPUT ONLY
ASYNCHRONOUS CLOCK SPEED SELECTION
00 ⇒ LOWEST SPEED
11 ⇒ HIGHEST SPEED

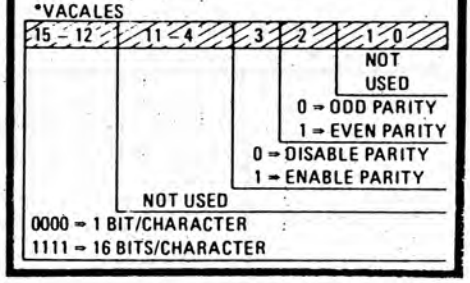


Figure 6. I/O Control Memory

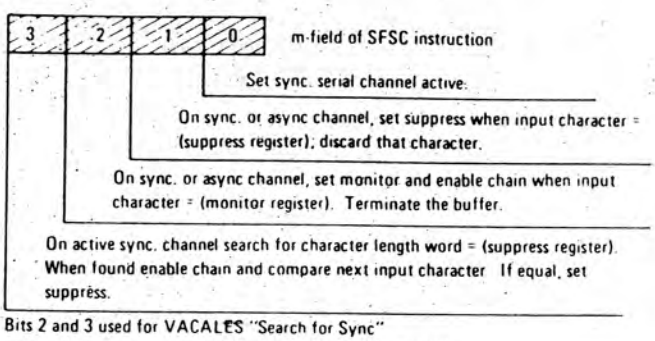

3
2
1
0
m-field of SFSC instruction
Set sync. serial channel active.
On sync. or async channel, set suppress when input character = (suppress register); discard that character.
On sync. or async channel, set monitor and enable chain when input character = (monitor register). Terminate the buffer.
On active sync. channel search for character length word = (suppress register). When found enable chain and compare next input character. If equal, set suppress.
Bits 2 and 3 used for VACALES "Search for Sync"

Figure 7. SFSC Operations

BITS	MIL-STD-188	RS-232	VACALES
0 - 7	ALWAYS ONES	ALWAYS ONES	ALWAYS ONES
8	1 ⇒ B DISCRETE TURNED ON	1 ⇒ RING INDICATOR ON	1 ⇒ B DISCRETE TURNED ON
9	1 ⇒ C DISCRETE TURNED OFF	1 ⇒ RECEIVED LINE SIGNAL DETECTOR OFF	1 ⇒ CARRIER DETECT TURNED OFF
10	1 ⇒ I DISCRETE TURNED ON	1 ⇒ I DISCRETE TURNED ON	1 ⇒ ALARM INDICATE TURNED ON
11	ALWAYS ONE	ALWAYS ONE	1 ⇒ SYNC ERROR TURNED ON
12	ALWAYS ONE	ALWAYS ONE	1 ⇒ TRANSMIT FULL ON TURNED OFF
13 - 15	ALWAYS ONES	ALWAYS ONES	ALWAYS ONES

Figure 8. Serial Channel Interrupt Word Format

TABLE 3. SERIAL I/O DISCRETE FUNCTIONS

Octal m-Value	Function	MIL-STD-188C/VACALES			EIA-STD-RS232	
		Discrete	Line Designator (188C)	Line Designator (Vacales)	Discrete	Line Designator
0	Set	Loop test (internal)	–	–	Loop test (internal)	–
1	Clear	Loop test (internal)	–	–	Loop test (internal)	–
2	NoOp	Not used	–	–	Spare	–
3	NoOp	Not used	–	–	Spare	–
4	Set	Control Line 6	J	J	J (non-std.)	–
5	Clear	Control Line 6	J	J	J (non-std.)	–
6	Set	Control Line 5	H	TRAN. PREP	Disable Ring Indicator Interrupt (internal)	–
7	Clear	Control Line 5	H	TRAN. PREP	Enable Ring Indicator Interrupt (internal)	–
10	Clear	Control Line 4	G	G	Request to Send	CA
11	Set	Control Line 4	G	G	Request to Send	CA
12	Clear	Control Line 3	F	F	New Sync	CH
13	Set	Control Line 3	F	F	New Sync	CH
14	Clear	Control Line 2	D	D	Data Terminal Ready	CD
15	Set	Control Line 2	D	D	Data Terminal Ready	CD
16	Clear	Control Line 1	A	LOOP BACK	Loop Test (external)	
17	Set	Control Line 1	A	LOOP BACK	Loop Test (external)	

TABLE 4. SERIAL I/O STATUS INTERPRETATION

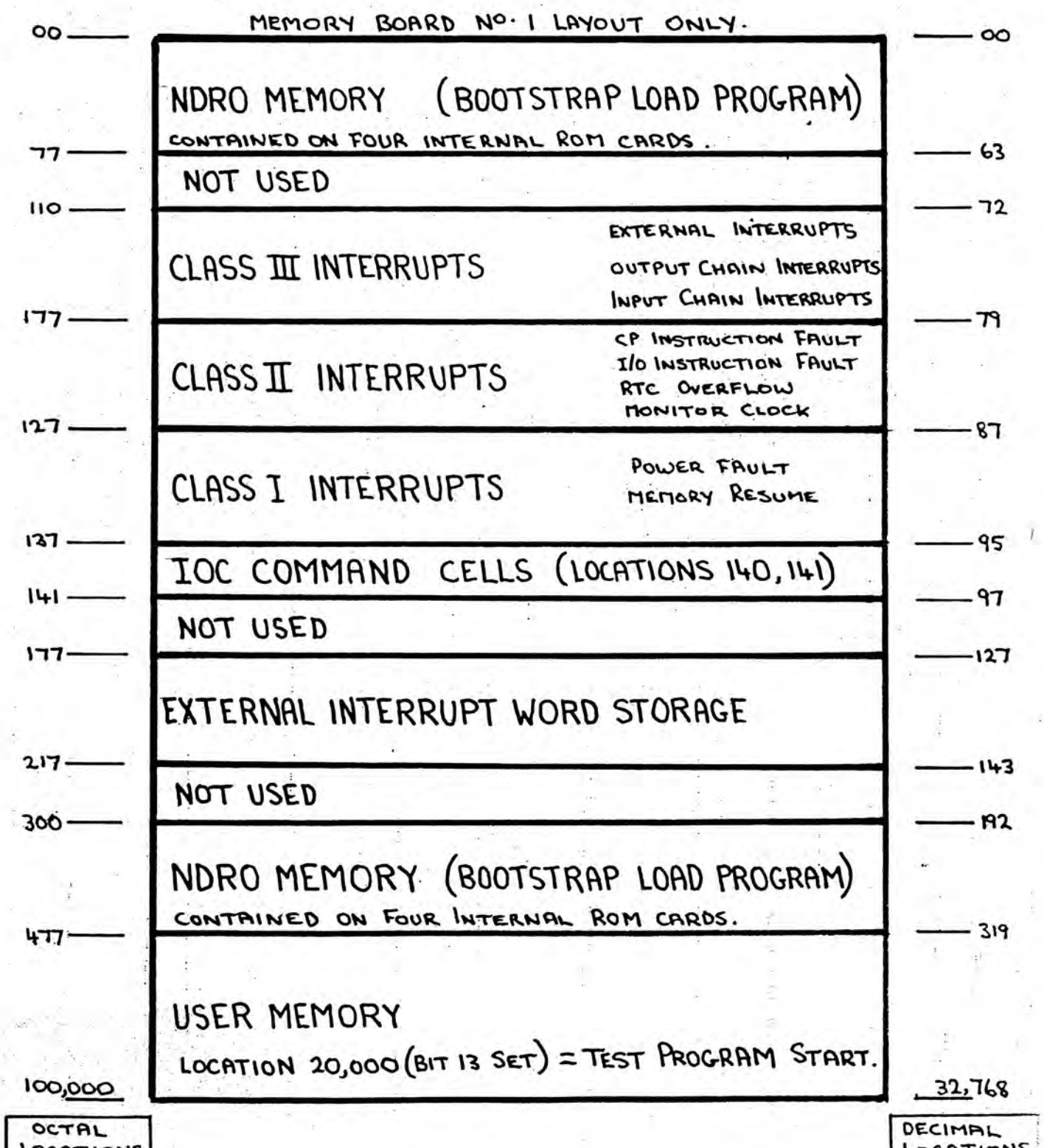
Word Bit #	MIL-STD-188 Function	EIA-STD-RS232 Function	VACALES FUNCTION
2^0	Parity Error	Parity Error	–
2^1	Overrun	Overrun	Overrun
2^2	Break	Break	Parity Error
2^3	E Active	Clear to Send	Sync Error

U1600EM COMPUTER MEMORY MAP

THE U1600EM COMPUTER MAIN MEMORY CONTAINS A MAXIMUM OF EIGHT. 32768_{10} SIXTEEN BIT WORD MEMORY BOARDS OF MAGNETIC CORE STORAGE.

TOTAL MEMORY CAPACITY (8 CARDS) = 262K X 16 BIT WORDS

READ / WRITE CYCLE TIME = 725 nSECONDS.



U1600EM COMPUTER CONNECTOR PLUG PIN ASSIGNMENTS

FUNCTION		120 PIN		90 PIN		85 PIN	
INPUT CHANNEL CONNECTOR	OUTPUT CHANNEL CONNECTOR	SIGNAL	RETURN	SIGNAL	RETURN	SIGNAL	RETURN
IN. DATA REQ.	OUT. ACK.	B-5	A-5	1	11	1	6
IN. ACK.	OUT. DATA REQ.	B-6	A-6	2	12	2	7
EXT. INT. REQ.	EXT. FUNCT. ACK.	B-7	A-7	3	13	3	8
EXT. INT. ENABLE	EXT. FUNCT. REQ.	B-8	A-8	4	14	4	9
DATA BIT 00		D-1	C-1	9	19	13	21
DATA BIT 01		D-2	C-2	10	20	14	22
DATA BIT 02		D-3	C-3	22	33	15	23
DATA BIT 03		D-4	C-4	23	34	16	24
DATA BIT 04		D-5	C-5	24	35	17	25
DATA BIT 05		D-6	C-6	25	36	18	26
DATA BIT 06		D-7	C-7	26	37	29	39
DATA BIT 07		D-8	C-8	27	38	30	40
DATA BIT 08		D-9	C-9	28	39	31	41
DATA BIT 09		D-10	C-10	29	40	32	42
DATA BIT 10		D-11	C-11	30	41	33	43
DATA BIT 11		D-12	C-12	31	42	34	44
DATA BIT 12		G-1	H-1	32	43	35	45
DATA BIT 13		G-2	H-2	47	58	36	46
DATA BIT 14		G-3	H-3	48	59	37	47
DATA BIT 15		G-4	H-4	49	60	49	58
DATA BIT 16		G-5	H-5	50	61	50	59
DATA BIT 17		G-6	H-6	51	62	51	60
DATA BIT 18		G-7	H-7	52	63	52	61
DATA BIT 19		G-8	H-8	53	64	53	62
DATA BIT 20		G-9	H-9	54	65	54	63
DATA BIT 21		G-10	H-10	55	66	55	64
DATA BIT 22		G-11	H-11	56	67	56	65
DATA BIT 23		G-12	H-12	57	68	57	66
DATA BIT 24		J-1	K-1	70	80	67	75
DATA BIT 25		J-2	K-2	71	81	68	76
DATA BIT 26		J-3	K-3	72	82	69	77
DATA BIT 27		J-4	K-4	73	83	70	78
DATA BIT 28		J-5	K-5	74	84	71	79
DATA BIT 29		J-6	K-6	75	85	72	80
DATA BIT 30		J-7	K-7	76	86	73	81
DATA BIT 31		J-8	K-8	77	87	5	12
DATA BIT 32		J-9	K-9	5	15	10	11
DATA BIT 33		J-10	K-10	6	16	82	83
DATA BIT 34		J-11	K-11	7	17	19	27
DATA BIT 35		T12	K-12	8	18	84	85
SHIELD			B-1		45		74
SHIELD			A-1*		69*		
SPARE		B-2	A-2	21		20	
SPARE		B-3	A-3	44		28	Not Used
SPARE		B-4	A-4	46		38	
SPARE		B-9	A-9	78	Not Used	48	
SPARE		B-10	A-10	79			
SPARE		B-11	A-11	88			
SPARE		B-12	A-12	89			
SPARE		F-1	E-1	90			
SPARE		F-2	E-2				
SPARE	Refer to the	F-3	E-3				
SPARE	individual	F-4	E-4				
SPARE	cable drawing	F-5	E-5				
SPARE		F-6	E-6				
SPARE		F-7	E-7				
SPARE		F-8	E-8				
SPARE		F-9	E-9				
SPARE		F-10	E-10				
SPARE		F-11	E-11				
SPARE		F-12	E-12				

*Pins A-1 and 69 are Secondary Shield connections.

Data bits and control lines not used by a device will have no connection

QUICK FIND GUIDE TO EF WORDS FOR EACH UNIT OF THE SFCS.

TWFCSI

ABR 5309, CHAP. 3, SECT. 2, PAGE 15/16.

EF 1: READ MPU RAM
EF 2: WRITE MPU RAM
EF 3: INITIALISE
EF 5: CODE 1, READ TOTE DISPLAY RAM
EF 5: CODE 2, WRITE TOTE DISPLAY RAM
EF 5: CODE 3, WRITE ALL TOTE DISPLAY
EF 6: INDICATOR FUNCTIONS

CRT

ABR 5309, CHAP. 3, SECT. 2, PAGE 53/54

EF 0: REFRESH MEMORY TRANSFER WORD
EF 1: STATUS REQUEST WORD

WDC

ABR 5311, CHAP. 3, SECT. 2, PAGE 25/36B

EF 81: INITIALISE
EF 82: MK 48 TWO STATES
EF 83: MK 48 TWO STATES
EF 84: MK 48 MULTI STATES
EF 85: MK 48 MULTI STATES
EF 86: MK 48 MULTI STATES
EF 87: STATUS AND TEST FUNCTIONS
EF 88: SYNCRONOUS PRESET GYRO
EF 89: SYNCRONOUS PRESET GYRO
EF 8A: SYNCRONOUS PRESET DEPTH
EF 8C: TUBE 1 ORDERS
EF 8D: TUBE 2 ORDERS
EF 8E: TUBE 3 ORDERS
EF 8F: TUBE 4 ORDERS
EF 90: TUBE 5 ORDERS
EF 91: TUBE 6 ORDERS
EF 92: MK 48 COMMANDS LEFT
EF 93: MK 48 COMMANDS RIGHT
EF 94: TELCOM TEST
EF 95: LOOP TEST
EF 96: REQUEST TUBE STATUS
EF 97: SEND ITL TO TUBE
EF 98: RESTART UGM
EF 99: ORDER BIT
EF 9A: REMOVE POWER TO SOLENOID
EF 9B: ORDER RANGE SAFE
EF B : UGM TRANSFER WITH FORCE
EF C : UGM TRANSFER
EF D : TRANSFER SDM TIME
EF E : READBACK DATA
EF F : FIRE ORDER

R/R

ABR 5310, CHAP. 3, SECT. 2, PAGE 61/62

EF 0: HALT
EF 3: WRITE
EF 6: ERASE
EF 9: REWIND
EF A: SPACE AHEAD
EF B: READ
EF C: BACK SPACE
EF E: INTERFACE TEST
EF 20:STATUS

SDC

ABR 5310, CHAP. 3, SECT. 2, PAGE 17-24

EF 1: READ MPU RAM
EF 2: WRITE MPU RAM
EF 3: INITIALISE
EF 4: CONTROLLER FUNCTIONS
EF 5: RANGER
EF 6: ATTACKER SONAR BLOCK
EF 7: ATTACKER SIMULATE BLOCK
EF 8: 2007
EF 9: SYNCRO DATA
EF A: EXTERNAL FUNCTION
EF B: TIME COUNTER
EF C: BLOCK TRANSFER
EF D: EXPRESS TRANSFER

CD

ABR 5310, CHAP. 3, SECT. 2, PAGE 47-56D

EF 1: READ MPU RAM
EF 2: WRITE MPU RAM
EF 3: INITIALISE
EF 4: CONTROL FUNCTIONS
EF 5: PLOTTER FUNCTIONS
EF 6: INDICATOR FUNCTIONS
EF 7: READ KEYBOARD BUFFER
EF 8: WRITE KEYBOARD BUFFER

MMU

ABR 5312, CHAP. 3, SECT. 1, PAGE 13/14

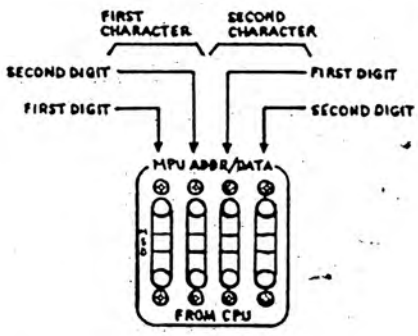
EF 0: HALT
EF 4: READ
EF 8: WRITE
EF C: REQUEST STATUS
EF D: RETURN SECTOR ADDRESS
EF E: RETURN TRACK ADDRESS

ASCII CODE TABLE

CRT CHARACTERS

TWFCSI CHARACTERS

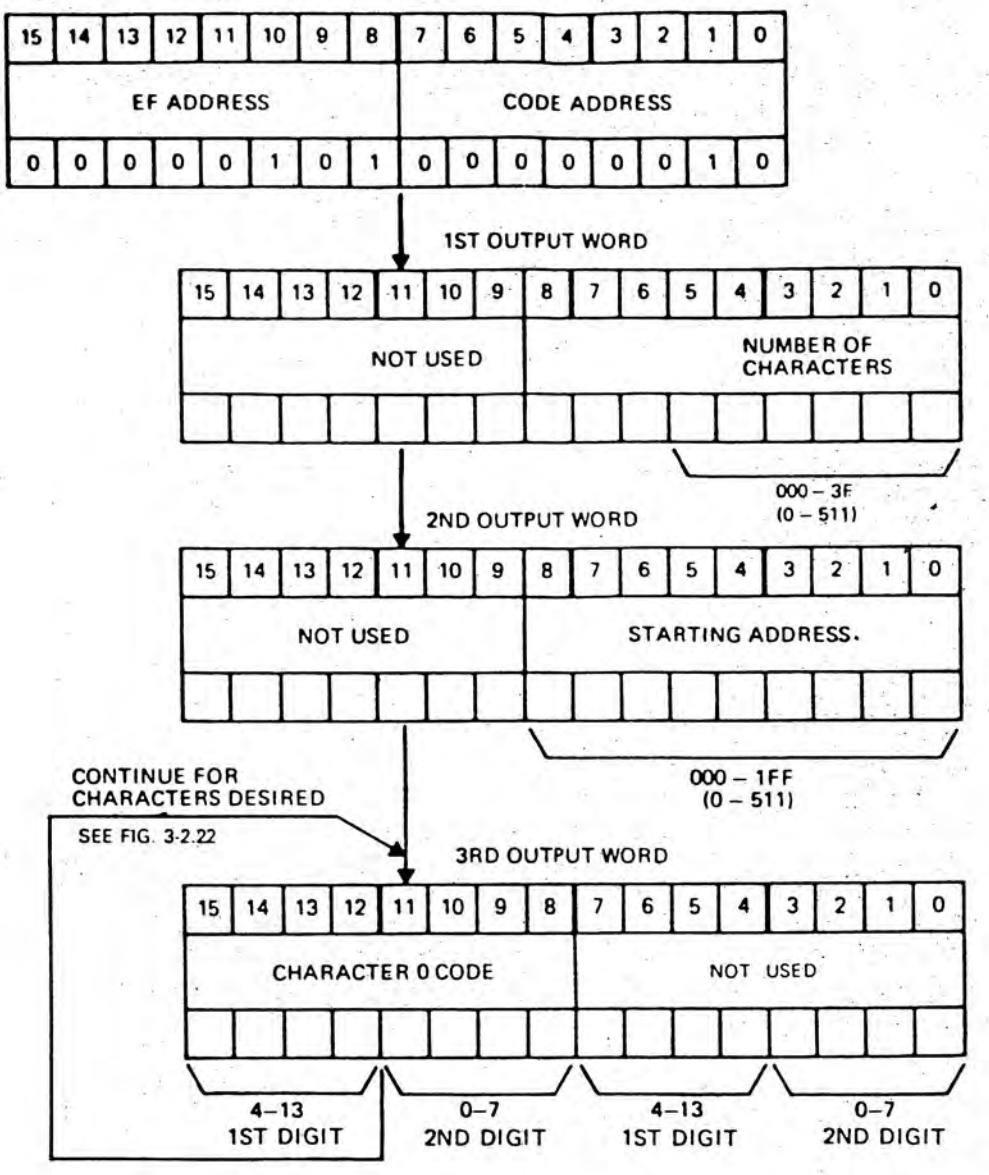
SECOND DIGIT \ FIRST DIGIT	0	1	2	3	4	5
0	NULL	◯	SPACE	0	→	P
1		|	!	1	A	Q
2	⌐	+	"	2	B	R
3	⌒	=	#	3	C	S
4	^	⌗	$	4	D	T
5	□	⌗	%	5	E	U
6	○	◇	&	6	F	V
7	⊙	⊕	'	7	G	W
8	BACK SPACE	⊕	(	8	H	X
9	∪	•	)	9	I	Y
10	∨	⊕	*	:	J	Z
11	△	°	+	;	K	[
12	△	×	,	<	L	\
13	⊡	o	—	=	M	]
14	⌴	◈	.	>	N	↑
15	⊗	↓	/	?	O	←



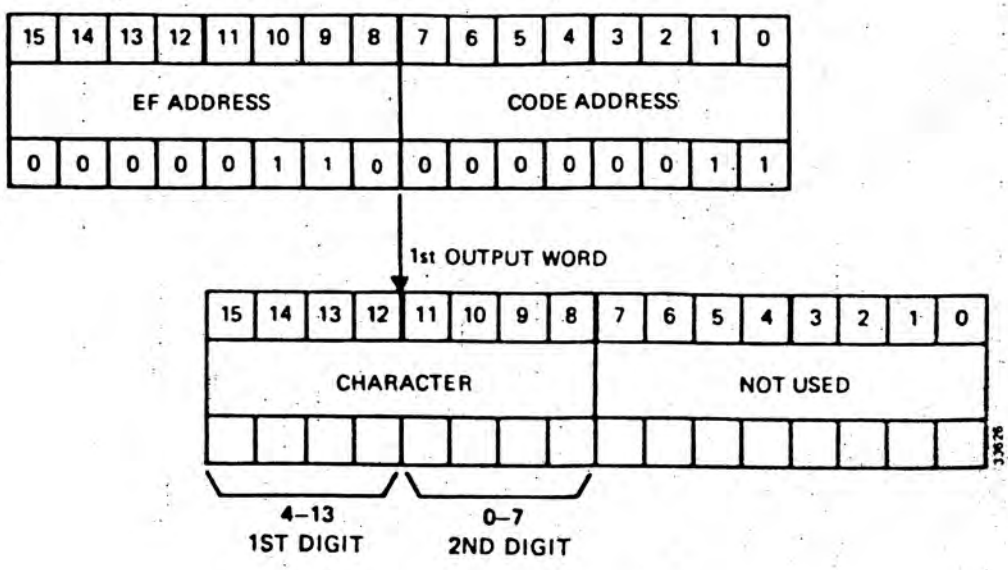
EXAMPLE: HOW TO PRINT "THIS IS A TEST."

FUNCTION	MPU ADDR/DATA FROM CPU SWITCH				PRINT CHARACTER		NTDS-ODA SWITCH
	FIRST CHARACTER		SECOND CHARACTER				
	FIRST DIGIT	SECOND DIGIT	FIRST DIGIT	SECOND DIGIT	FIRST CHARACTER	SECOND CHARACTER	
CHARACTER OUTPUT DATA WORD	5	4	4	8	T	H	PRESS
	4	9	5	3	I	S	PRESS
	2	0	4	9	SPACE	I	PRESS
	5	3	2	0	S	SPACE	PRESS
	4	1	2	0	A	SPACE	PRESS
	5	4	4	5	T	E	PRESS
	5	3	5	4	S	T	PRESS

WRITE TOTE DISPLAY MEMORY-EF5 CODE 2


15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
EF ADDRESS
CODE ADDRESS
0 0 0 0 0 1 0 1 0 0 0 0 0 0 1 0
1ST OUTPUT WORD
NOT USED
NUMBER OF CHARACTERS
000 – 3F (0 – 511)
2ND OUTPUT WORD
NOT USED
STARTING ADDRESS.
000 – 1FF (0 – 511)
CONTINUE FOR CHARACTERS DESIRED
SEE FIG. 3-2.22
3RD OUTPUT WORD
CHARACTER 0 CODE
NOT USED
4–13 1ST DIGIT
0–7 2ND DIGIT
4–13 1ST DIGIT
0–7 2ND DIGIT

WRITE ALL TOTE DISPLAY-EF5 CODE 3


15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
EF ADDRESS
CODE ADDRESS
0 0 0 0 0 1 1 0 0 0 0 0 0 0 1 1
1st OUTPUT WORD
CHARACTER
NOT USED
4–13 1ST DIGIT
0–7 2ND DIGIT
3828

SWITCH INTERRUPT CODES

IDENT BITS 15, 14	FUNCTION CODE BITS 13-8 OCTAL	SWITCH-INDICATOR
00	00	ILLEGAL
00	01	CYCLE TOTE
00	02	01/CHOOSE
00	03	02/CHOOSE
00	04	03/CHOOSE
00	05	04/CHOOSE
00	06	MK8/ASSIGN
00	07	UGM84/ASSIGN
00	10	MK48/ASSIGN
00	11	W/S
00	12	6/ALLOC
00	13	4/ALLOC
00	14	2/ALLOC
00	15	1/ALLOC
00	16	3/ALLOC
00	17	5/ALLOC
00	20	SPARE 2
00	21	SPARE 3
00	22	AUTO/MAN
00	23	ENTER
00	24	EX-BIT
00	25	SURF/SUB
00	26	AM-PAS/AM-ACT
00	27	ASH-1/ASH-0
00	30	PING-L/PING-S
00	31	DPLR-1/DPLR-0
00	32	RUN-H/RUN-M
00	33	SRCH-M/SRCH-L
00	34	X10
00	35	SET/R-BACK
00	36	JOYSTICK-UP
00	37	JOYSTICK-DOWN
00	40	JOYSTICK-LEFT
00	41	JOYSTICK-RIGHT
00	42	UP-ARROW
00	43	DN-ARROW
00	44	MATCH OVERRIDE
00	45	UNASSIGNED
↕	↕	↕
00	77	UNASSIGNED
01	00	ILLEGAL
01	01	PATROL 6
01	02	PATROL 4
01	03	PATROL 2
01	04	PATROL 1
01	05	PATROL 3
01	06	PATROL 5

IDENT BITS 15, 14	FUNCTION CODE BITS 13-8 OCTAL	SWITCH-INDICATOR
01	07	ACTION 6
01	10	ACTION 4
01	11	ACTION 2
01	12	ACTION 1
01	13	ACTION 3
01	14	ACTION 5
01	15	STBY 6
01	16	STBY 4
01	17	STBY 2
01	20	STBY 1
01	21	STBY 3
01	22	STBY 5
01	23	BOWCAP 6
01	24	BOWCAP 4
01	25	BOWCAP 2
01	26	BOWCAP 1
01	27	BOWCAP 3
01	30	BOWCAP 5
01	31	SELECT 6
01	32	SELECT 4
01	33	SELECT 2
01	34	SELECT 1
01	35	SELECT 3
01	36	SELECT 5
01	37	SPARE
01	40	SPARE
01	41	SPARE
01	42	SPARE
01	43	SPARE
01	44	SPARE
01	45	ILLEGAL
01	46	FIRE
01	47	UNASSIGNED
↕	↕	↕
01	77	UNASSIGNED

TWFCSI Switch Interrupts

SFCS MOD 1 CIRCUIT CARD DATA

CARD	TYPE	EQUIPMENT	LOCATION	CIRCUIT
	ABE	WDC	A4A211	TIC
	ABE	TOAD	A2A8-	TOAD
	ABE	TOAD	A2A26	TOAD
	AFA	FCC	A1A23	TOTE TIMING
	AFA	FCC	A1A24	TOTE TIMING
	AFA	FCC	A6A97	IG/MEM
	AFA	FCC	A7A55	MPU
	AFA	FCC	A7A56	MPU
	AFA	FCC	A7A133	INDC
	AFA	FCC	A7A134	INDC
	AFA	CDC	A3A20	IDI
	AFA	CDC	A3A21	IDI
	AFA	CDC	A3133	MPU1
	AFA	CDC	A3134	MPU1
	AFA	CDC	A3A157	MPU2
	AFA	CDC	A3A158	MPU2
	AFA	CDC	AA3A232	SDCV
	AFA	CDC	AA3A312	IDI
	AFA	CDC	A3A329	MPU3
	AFA	CDC	A3A330	MPU3
	AFA	WDC	A4A76	TLC
	AFA	WDC	A4A255	DDL
	AFA	WDC	A4A256	DDL
	AFA	WDC	A4A257	DDL
	AFA	WDC	A4A390	MPU
	AFA	WDC	A4A391	MPU
	BHA	FCC	A6A20	COC
	BHA	FCC	A6140	IG
	BHA	FCC	A6A71	IG
	BHA	FCC	A1A38	TOTE REFRESH
	BHA	CDC	A3A113	HMI/VMI
	BHA	CDC	A3A117	HMI

CARD	TYPE	EQUIPMENT	LOCATION	CIRCUIT
1	BHL	FCC	A6A26	VCC
2	BHL	FCC	A6A27	VCC
3	BHL	FCC	A6A29	VCC
4	BHL	FCC	A6A99	19
5	BHL	FCC	A6A141	19
6	BHL	FCC	A6A28	MP
7	BHL	CDC	A3A218	MP
8	BHL	CDC	A3A219	MP
9	BHL	WDC	A4A85	TLC
10	BHL	WDC	A4A260	DRL (BIT 0)
11	BHL	WDC	A4A261	DRL (BIT 0 & 7)
12	BHL	WDC	A4A262	DRL (BIT 1 & 7)
13	BHL	WDC	A4A263	DRL (BIT 2)
14	BHL	WDC	A4A264	DRL (BIT 2 & 3)
15	BHL	WDC	A4A265	DRL (BIT 3 & 7)
16	BHL	WDC	A4A266	DRL (BIT 4)
17	BHL	WDC	A4A267	DRL (BIT 4 & 5)
18	BHL	WDC	A4A268	DRL (BIT 5)
19	BHL	WDC	A4A269	DRL (BIT 6)
20	BHL	WDC	A4A270	DRL (BIT 7)
21	BHL	WDC	A4A409	TIMP
1	BJJ	FCC	A7A3	MPU
2	BJJ	FCC	A7A11	MPU
3	BJJ	FCC	A7A12	MPU
4	BJJ	FCC	A7A13	MPU
5	BJJ	FCC	A7A14	MPU
6	BJJ	FCC	A7A15	MPU
7	BJJ	FCC	A7A16	MPU
8	BJJ	FCC	A7A17	MPU
9	BJJ	FCC	A7A18	MPU
10	BJJ	FCC	A7A19	MPU
			Secondry Mode	
11	BJJ	FCC	A7A45	MPU
12	BJJ	WDC	A4A31	WYWG
13	BJJ	WDC	A4A32	WYWG
14	BJJ	WDC	A4A326	MPU
15	BJJ	WDC	A4A329	MPU
16	BJJ	WDC	A4A330	MPU
17	BJJ	WDC	A4A331	MPU

CARD	TYPE	EQUIPMENT	LOCATION	CIRCUIT
1	CHH	FCC	A6A13	COC
2	CHH	FCC	A6A15	COC
3	CHH	FCC	A6A18	IG/DOC/COC
4	CHH	FCC	A6A24	IG/COC/VCC
5	CHH	FCC	A6A58	IG/DOC
6	CHH	FCC	A6A61	DOC
7	CHH	FCC	A6A63	DOC
8	CHH	FCC	A6A68	IG/DOC
9	CHH	FCC	A6A69	IG/DOC/COC
10	CHH	FCC	A6A105	IG
11	CHH	FCC	A6A107	IG
12	CHH	FCC	A6A108	IG
13	CHH	FCC	A6A143	IG
14	CHH	FCC	A6A186	NSI/19
15	CHH	FCC	A6A29	MP
16	CHH	FCC	A7A88	WDC
17	CHH	FCC	A7A105	SWMX
18	CHH	CDC	A3A198	MP
19	CHH	WDC	A4A36	TLC/WYWG
20	CHH	WDC	A4A77	TLC
21	CHH	WDC	A4A78	TLC
22	CHH	WDC	A4A250	PWNM/MPU
23	CHH	WDC	A4A343	TIMP
24	CHH	WDC	A4A344	TIMP
25	CHH	WDC	A4A403	TIMP
26	CHH	WDC	A4A404	TIMP
27	CHH	WDC	A4A406	TIMP
1	CHP	FCC	A7A64	MON/SWMX
2	CHP	CDC	A3A24	SMI
3	CHP	CDC	A3A115	HMI/VMI
4	CHP	CDC	A3A195	MP
5	CHP	CDC	A3A227	SDCV
6	CHP	CDC	A3A228	MAMO
7	CHP	CDC	A3A308	MON
8	CHP	WDC	A4A45	SYPE
9	CHP	WDC	A4A296	TIMP/TIC

CARD	TYPE	EQUIP	LOCATION	CIRCUIT
1	CMC	FCC	A1A3	COLUMN/LINE SELECT DRIVERS
2	CMC	FCC	A1A4	COLUMN/LINE SELECT DRIVERS
3	CMC	FCC	A1A5	COLUMN/LINE SELECT DRIVERS
4	CMC	FCC	A1A6	COLUMN/LINE SELECT DRIVERS
5	CMC	FCC	A1A7	COLUMN/LINE SELECT DRIVERS
6	CMC	FCC	A1A8	COLUMN/LINE SELECT DRIVERS
7	CMC	FCC	A1A9	COLUMN/LINE SELECT DRIVERS
8	CMC	FCC	A1A10	COLUMN/LINE SELECT DRIVERS
9	CMC	FCC	A1A11	COLUMN/LINE SELECT DRIVERS
10	CMC	FCC	A1A12	COLUMN/LINE SELECT DRIVERS
11	CMC	FCC	A1A13	COLUMN/LINE SELECT DRIVERS
12	CMC	FCC	A1A14	COLUMN/LINE SELECT DRIVERS
13	CMC	FCC	A1A15	COLUMN/LINE SELECT DRIVERS
14	CMC	FCC	A1A16	COLUMN/LINE SELECT DRIVERS
15	CMC	FCC	A1A17	COLUMN/LINE SELECT DRIVERS
16	CMC	FCC	A1A18	COLUMN/LINE SELECT DRIVERS
1	DRH 6800	CDC	A3A130	MPU 1
2	DRH 6800	CDC	A3A154	MPU 2
3	DRH 6800	CDC	A3A325	MPU 3
1	DRJ	FCC	A7A46	MPU/MON
2	DRJ	CDC	A3A129	MPU 1/MON
3	DRJ	CDC	A3A153	MON/MPU 2
4	DRJ	CDC	A3A324	MPU 3
5	DRJ	WDC	A4A342	MPU/PWMN
1	DRL	FCC	A1A39	TOTE REFRESH
2	DRL	FCC	A6A49	MEM/COC
3	DRL	FCC	A6A51	MEM
4	DRL	FCC	A6A52	MEM
5	DRL	FCC	A6A53	MEM
6	DRL	FCC	A6A137	MEM
7	DRL	FCC	A6A138	MEM
8	DRL	FCC	A6A184	MEM
9	DRL	FCC	A6A185	MEM
10	DRL	FCC	A7A48	MPU
11	DRL	FCC	A7A49	MPU
12	DRL	FCC	A7A53	MPU
13	DRL	FCC	A7A58	MPU
14	DRL	FCC	A7A59	MPU
15	DRL	FCC	A7A76	TIF

CARD	TYPE	EQUIP	LOCATION	CIRCUIT
16	DRL	CDC	A3A126	MPU 1
17	DRL	CDC	A3A127	MPU 1
18	DRL	CDC	A3A131	MPU 1
19	DRL	CDC	A3A136	MPU 1
20	DRL	CDC	A3A137	MPU 1
21	DRL	CDC	A3A150	MPU 2
22	DRL	CDC	A3A151	MPU 2
23	DRL	CDC	A3A155	MPU 2
24	DRL	CDC	A3A160	MPU 2
25	DRL	CDC	A3A161	MPU 2
26	DRL	CDC	A3A323	MPU 3
27	DRL	CDC	A3A327	MPU 3
28	DRL	CDC	A3A332	MPU 3
29	DRL	WDC	A4A383	MPU
30	DRL	WDC	A4A384	MPU
31	DRL	WDC	A4A388	MPU
32	DRL	WDC	A4A393	MPU
33	DRL	WDC	A4A394	MPU
1	DRM	FCC	A1A34	TOTE REFRESH
2	DRM	FCC	A6A1	COC
3	DRM	FCC	A6A2	COC
4	DRM	FCC	A6A3	COC
5	DRM	FCC	A6A4	COC
6	DRM	FCC	A6A5	COC
7	DRM	FCC	A6A6	COC
8	DRM	FCC	A6A7	COC
9	DRM	FCC	A6A8	COC
10	DRM	CDC	A3A33	MPU 1
11	DRM	CDC	A3A34	MPU 1
12	DRM	CDC	A3A35	MPU 1
13	DRM	CDC	A3A36	MPU 1
14	DRM	CDC	A3A37	MPU 1
15	DRM	CDC	A3A38	MPU 1
16	DRM	CDC	A3A39	MPU 1
17	DRM	CDC	A3A40	MPU 1
18	DRM	CDC	A3A41	MPU 1
19	DRM	CDC	A3A42	MPU 1
20	DRM	CDC	A3A43	MPU 1

CARD	TYPE	EQUIP	LOCATION	CIRCUIT
21	DRM	CDC	A3A58	MPU 2
22	DRM	CDC	A3A59	MPU 2
23	DRM	CDC	A3A61	MPU 2
24	DRM	CDC	A3A62	MPU 2
25	DRM	CDC	A3A63	MPU 2
26	DRM	CDC	A3A64	MPU 2
27	DRM	CDC	A3A65	MPU 2
28	DRM	CDC	A3A66	MPU 2
29	DRM	CDC	A3A67	MPU 2
30	DRM	CDC	A3A68	MPU 2
31	DRM	CDC	A3A69	MPU 2
32	DRM	CDC	A3A70	MPU 2
33	DRM	CDC	A3A71	MPU 2
34	DRM	CDC	A3A123	MPU 1
35	DRM	CDC	A3A124	MPU 1
36	DRM	CDC	A3A316	MPU 3
37	DRM	CDC	A3A317	MPU 3
38	DRM	CDC	A3A318	MPU 3
39	DRM	CDC	A3A319	MPU 3
40	DRM	CDC	A3A320	MPU 3
41	DRM	CDC	A3A321	MPU 3
42	DRM	CDC	A3A326	MPU 3
1	DRN	FCC	A7A1	MPU
2	DRN	FCC	A7A2	MPU
3	DRN	FCC	A7A20	MPU
4	DRN	FCC	A7A21	MPU
5	DRN	FCC	A7A22	MPU
6	DRN	FCC	A7A23	MPU
7	DRN	FCC	A7A43	MPU
8	DRN	FCC	A7A44	MPU
9	DRN	FCC	A7A60	MPU
10	DRN	FCC	A7A61	MPU
11	DRN	FCC	A7A62	MPU
12	DRN	FCC	A3A63	MPU
13	DRN	CDC	A3A29	MPU 1
14	DRN	CDC	A3A30	MPU 1
15	DRN	CDC	A3A48	MPU 1
16	DRN	CDC	A3A49	MPU 1
17	DRN	CDC	A3A50	MPU 1

CARD	TYPE	EQUIP	LOCATION	CIRCUIT
18	DRN	CDC	A3A51	MPU 1
19	DRN	CDC	A3A53	MPU 2
20	DRN	CDC	A3A54	MPU 2
21	DRN	CDC	A3A72	MPU 2
23	DRN	CDC	A3A74	MPU 2
24	DRN	CDC	A3A75	MPU 2
25	DRN	CDC	A3A138	MPU 1
26	DRN	CDC	A3A139	MPU 1
27	DRN	CDC	A3A140	MPU 1
28	DRN	CDC	A3A141	MPU 1
29	DRN	CDC	A3A146	MPU 2
30	DRN	CDC	A3A162	MPU 2
31	DRN	CDC	A3A163	MPU 2
32	DRN	CDC	A3A164	MPU 2
33	DRN	CDC	A3A165	MPU 2
34	DRN	CDC	A3A333	MPU 3
35	DRN	CDC	A3A335	MPU 3
36	DRN	CDC	A3A336	MPU 3
37	DRN	CDC	A3A337	MPU 3
38	DRN	CDC	A3A338	MPU 3
39	DRN	CDC	A3A339	MPU 3
40	DRN	WDC	A3A316	MPU
41	DRN	WDC	A3A317	MPU
42	DRN	WDC	A3A335	MPU
43	DRN	WDC	A3A336	MPU
44	DRN	WDC	A4A337	MPU
45	DRN	WDC	A4A338	MPU
46	DRN	WDC	A4A377	MPU
47	DRN	WDC	A4A378	MPU
48	DRN	WDC	A4A379	MPU
49	DRN	WDC	A4A395	MPU
50	DRN	WDC	A4A396	MPU
51	DRN	WDC	A4A397	MPU
52	DRN	WDC	A4A398	MPU

CARD	TYPE	EQUIP	LOCATION	CIRCUIT
1	EHK	FCC	A6A48	NSI/MEM
2	EHK	FCC	A6A47	MEM
3	EHK	FCC	A6A65	NSI/CG/MEM/VCC
4	EHK	FCC	A6A66	VCC
5	EHK	FCC	A6A111	IG/VCC
6	EHK	FCC	A6A150	NSI
7	EHK	FCC	A6A195	NSI
8	EHK	FCC	A6A10	MPU
9	EHK	FCC	A6A26	MP
10	EHK	FCC	A6A33	MP
11	EHK	FCC	A6A34	MP
12	EHK	FCC	A6A54	MPU
13	EHK	FCC	A6A72	MP
14	EHK	FCC	A6A73	MP
15	EHK	FCC	A6A74	MP
16	EHK	FCC	A7A186	NS
17	EHK	CDC	A3A91	IDI
18	EHK	CDC	A3A92	HMI/VMI
19	EHK	CDC	A3A93	DRT/SMI
20	EHK	CDC	A3A94	IDI
21	EHK	CDC	A3A95	IDI
22	EHK	CDC	A3A96	IDI
23	EHK	CDC	A3A102	NSI
24	EHK	CDC	A3A109	IDI
25	EHK	CDC	A3A110	IDI
26	EHK	CDC	A3A132	MPU 1
27	EHK	CDC	A3A156	MPU 2
28	EHK	CDC	A3A168	NS 2
29	EHK	CDC	A3A187	MP
30	EHK	CDC	A3A188	MP
31	EHK	CDC	A3A189	MP
32	EHK	CDC	A3A190	MP
33	EHK	CDC	A3A191	MP
34	EHK	CDC	A3A192	MP
35	EHK	CDC	A3A193	MP
36	EHK	CDC	A3A328	MPU 3
37	EHK	CDC	A3A345	MT 1
38	EHK	CDC	A3A349	NS 3
39	EHK	CDC	A4A300	TIMP
40	EHK	WDC	A4A382	MPU

CARD	TYPE	EQUIP	LOCATION	CIRCUIT
41	EHK	WDC	A4A399	TIMP (RIGHT)
42	EHK	WDC	A4A400	TIMP (RIGHT)
43	EHK	WDC	A4A401	TIMP (LEFT)
44	EHK	WDC	A4A402	TIMP (LEFT)
45	EHK	FCC	A1A30	TOTE TIMING/REFRESH/DIMMING
46	EHK	CDC	A3A313	IDI
47	EHK	FCC	A7A109	SWMX
48	EHK	FCC	A7A135	INDC
49	EHK	FCC	A7A136	INDC
50	EHK	WDC	A4A253	DDL
51	EHK	WDC	A4A254	DDL/DRL/PWMN
52	EHK	WDC	A4A339	MIIF
53	EHK	WDC	A4A340	TIMP
54	EHK	WDC	A4A341	TIMP
55	EHK	WDC	A4A389	MPU
1	EJC	FCC	A1A21	TOTE TIMING/DIMMING
2	EJC	FCC	A7A71	MP
3	EJC	FCC	A7A144	MP
4	EJC	FCC	A7A145	WDC/INDC
5	EJC	FCC	A7A146	INDC
6	EJC	FCC	A7A147	INDC
7	EJC	FCC	A7A148	INDC
8	EJC	FCC	A7A149	INDC
9	EJC	FCC	A7A150	INDC
10	EJC	FCC	A7A151	INDC
11	EJC	FCC	A7A152	INDC
12	EJC	FCC	A7A153	INDC
13	EJC	FCC	A7A154	INDC
14	EJC	FCC	A7A155	INDC
15	EJC	FCC	A7A156	INDC
16	EJC	FCC	A7A157	INDC
17	EJC	CDC	A3A1	DI
18	EJC	CDC	A3A2	DI
19	EJC	CDC	A3A3	DI
20	EJC	CDC	A3A4	DI
21	EJC	CDC	A3A5	DI
22	EJC	CDC	A3A6	DI
23	EJC	CDC	A3A7	DI
24	EJC	CDC	A3A8	PPE/IDI
25	EJC	CDC	A3A169	TM

CARD	TYPE	EQUIP	LOCATION	CIRCUIT
26	EJC	CDC	A3A181	MP
27	EJC	CDC	A3A307	MON/DI
28	EJC	WDC	A4A26	MIIF
29	EJC	WDC	A4A84	TLC
30	EJC	WDC	A4A171	MIIF
31	EJC	WDC	A4A172	TSMF (PEPD/PEGA)
32	EJC	WDC	A4A173	TSMF (PETU/PEWY)
33	EJC	WDC	A4A174	TSMF (WYAG)
34	EJC	WDC	A4A175	MIIF
35	EJC	WDC	A4A176	TSMF (SCFI/FISJ)
36	EJC	WDC	A4A177	MIIF
37	EJC	WDC	A4A178	TSMF (TEST/MIIF)
38	EJC	WDC	A4A218	TIC (TUBE 1)
39	EJC	WDC	A4A219	TIC (TUBE 2)
40	EJC	WDC	A4A220	TIC (TUBE 3)
41	EJC	WDC	A4A221	TIC (TUBE 4)
42	EJC	WDC	A4A222	TIC (TUBE 5)
43	EJC	WDC	A4A223	TIC (TUBE 6)
44	EJC	WDC	A4A224	TIMP/TIC
45	EJC	WDC	A4A420	TIMP/PWMN
1	EYA	FCC	A1A35	TOTE REFRESH
2	EYA	FCC	A6A81	MEM
3	EYA	FCC	A6A82	MEM
4	EYA	FCC	A6A83	MEM
5	EYA	FCC	A6A84	MEM
6	EYA	FCC	A6A85	MEM
7	EYA	FCC	A6A86	MEM
8	EYA	FCC	A6A87	MEM
9	EYA	FCC	A6A88	MEM
10	EYA	FCC	A6A89	MEM
11	EYA	FCC	A6A90	MEM
12	EYA	FCC	A6A91	MEM
13	EYA	FCC	A6A92	MEM
14	EYA	FCC	A6A93	MEM
15	EYA	FCC	A6A94	MEM
16	EYA	FCC	A6A95	MEM
17	EYA	FCC	A6A96	MEM

CARD	TYPE	EQUIP	LOCATION	CIRCUIT
18	EYA	CDC	A3A27	MPU 1
19	EYA	CDC	A3A28	MPU 1
20	EYA	CDC	A3A31	MPU 1
21	EYA	CDC	A3A32	MPU 1
22	EYA	CDC	A3A55	MPU 2
23	EYA	CDC	A3A56	MPU 2
24	EYA	CDC	A3A322	MPU 3
1	FEA	FCC	A1A27	TOTE TIMING
2	FEA	FCC	A1A28	TOTE TIMING
3	FEA	FCC	A1A29	TOTE TIMING/REFRESH
4	FEA	FCC	A6A9	COC
5	FEA	FCC	A6A19	COC
6	FEA	FCC	A6A22	CG
7	FEA	FCC	A6A23	COC
8	FEA	FCC	A6A30	VCC
9	FEA	FCC	A6A41	MEM
10	FEA	FCC	A6A42	MEM
11	FEA	FCC	A6A67	CG
12	FEA	FCC	A6A98	IG/COC
13	FEA	FCC	A6A100	COC
14	FEA	FCC	A6A142	CG
15	FEA	FCC	A6A181	IG
16	FEA	FCC	A6A182	IG/MEM
17	FEA	FCC	A7A90	WDC
18	FEA	FCC	A7A112	DMCO
19	FEA	FCC	A7A113	DMCO
20	FEA	FCC	A7A188	NS
21	FEA	FCC	A7A189	NS
22	FEA	CDC	A3A76	NS2
23	FEA	CDC	A3A77	NS2
24	FEA	CDC	A3A103	NS1
25	FEA	CDC	A3A104	NS1
26	FEA	CDC	A3A166	SDCV/KEY
27	FEA	CDC	A3A222	CLK
28	FEA	CDC	A3A223	CLK
29	FEA	CDC	A3A224	CLK
30	FEA	CDC	A3A225	CLK

CARD	TYPE	EQUIP	LOCATION	CIRCUIT
31	FEA	CDC	A3A305	DIM
32	FEA	CDC	A3A344	MTJ
33	FEA	CDC	A3A347	NS 3
34	FEA	CDC	A3A348	NS 3
35	FEA	WDC	A3A33	WYWG (RIGHT)
36	FEA	WDC	A3A34	WYWG (LEFT)
37	FEA	WDC	A3A37	WYWG (TONE)
38	FEA	WDC	A4A140	TLC (RIGHT)
39	FEA	WDC	A4A141	TLC (RIGHT)
40	FEA	WDC	A4A142	TLC (LEFT/SIMU)
41	FEA	WDC	A4A143	TLC (LEFT)
42	FEA	WDC	A4A144	TLC (SIMU)
43	FEA	WDC	A4A145	TLC (SIMU)
44	FEA	WDC	A4A146	TLC (SIMU)
45	FEA	WDC	A4A354	TIMP (RIGHT)
1	FFG	FCC	A1A20	TOTE TIMING
2	FFG	FCC	A7A114	OMCO
3	FFG	FCC	A7A115	MON
4	FFG	FCC	A7A116	MON
5	FFG	FCC	A7A117	MON
6	FFG	CDC	A3A301	MON
7	FFG	CDC	A3A302	MON
8	FFG	CDC	A3A303	MON
9	FFG	CDC	A3A304	DIM
10	FFG	WDC	A4A244	PWMN
11	FFG	WDC	A4A245	PWMN
12	FFG	WDC	A4A246	PWMN
13	FFG	WDC	A4A247	PWMN
14	FFG	WDC	A4A248	PWMN
15	FFG	WDC	A4A278	TWMK (TUBE 1)
16	FFG	WDC	A4A279	TWMK (TUBE 2)
17	FFG	WDC	A4A280	TWMK (TUBE 3)
18	FFG	WDC	A4A281	TWMK (TUBE 4)
19	FFG	WDC	A4A282	TWMK (TUBE 5)
20	FFG	WDC	A4A283	TWMK (TUBE 6)
21	FFG	TOAD	A2A31	TOAD
22	FFG	TOAD	A2A32	TOAD
23	FFG	CDC	A3A300	MON/CLK

CARD	TYPE	EQUIP	LOCATION	CIRCUIT
1	FMF	FCC	A1A40	TOTE
2	FMF	FCC	A6A196	NSI
3	FMF	FCC	A7A77	MON/TIF
4	FMF	CDC	A3A311	MON
5	FMF	WDC	A4A271	TWMK/PWMN/MIIF
6	FMF	WDC	A4A299	TIC/TSMF/MIIF
7	FMF	FCC	A6A110	NSI/IG
1	FPN	CDC	A3A298	CDC SHEETS
2	FPN	WDC	A4A242	PWMN
1	FQM	FCC	A7A52	MPU
2	FQM	WDC	A4A387	MPU
1	FQR	FCC	A6A6	MPU
2	FQR	FCC	A6A7	MPU
3	FQR	FCC	A6A8	MPU
4	FQR	FCC	A6A9	MPU
5	FQR	WDC	A4A318	MPU
6	FQR	WDC	A4A319	MPU
7	FQR	WDC	A4A320	MPU
8	FQR	WDC	A4A321	MPU
1	FRD	TOAD	A2A10	TOAD
2	FRD	TOAD	A2A12	TOAD
1	FVC	FCC	A1A25	TOTE TIMING
2	FVC	CDC	A3A226	CLK
3	FVC	WDC	A4A22	WYWG
4	FVC	FCC	A4A23	WYWG
1	GBP	WDC	A4A94	WYWG (LEFT)
2	GHK			

CARD	TYPE	EQUIP	LOCATION	CIRCUIT
1	GHK	FCC	A1A31	TOTE TIMING
2	GHK	FCC	A1A32	TOTE TIMING
3	GHK	FCC	A6A60	DOC
4	GHK	FCC	A6A54	IG/COC
5	GHK	FCC	A6A104	19
6	GHK	FCC	A6A109	19
7	GHK	FCC	A6A149	NSI/19/MEM
8	GHK	FCC	A6A189	NSI
9	GHK	CDC	A3A15	PPE
10	GHK	CDC	A3A204	MP
11	GHK	CDC	A3A343	MTI
12	GHK	WDC	A4A35	WYWG
13	GHK	WDC	A4A40	SYPE
14	GHK	WDC	A4A86	TLC (RIGHT)
15	GHK	WDC	A4A87	TLC (LEFT)
16	GHK	WDC	A4A96	WYWG (TONE)
17	GHK	WDC	A4A97	WYWG (TONE)
18	GHK	WDC	A4A352	TIMP
19	GHK	WDC	A4A353	TIMP/MPU
20	GHK	WDC	A4A354	TIMP
21	GHK	FCC	A7A67	MP/WDC
1	GKR	WDC	A4A47	WYPE (RNFN)
2	GKR	WDC	A4A49	WYPE (RNCQ)
3	GKR	WDC	A4A51	WYPE (FG)
4	GKR	WDC	A4A53	WYPE (SD)
5	GKR	WDC	A4A55	WYPE (CGOH)
6	GKR	WDC	A4A57	WYPE (P1)
7	GKR	WDC	A4A59	WYPE (AM)
1	GMM	WDC	A4A113	WYPE (PU)
2	GMM	WDC	A4A114	WYPE (DOEN)
3	GMM	WDC	A4A115	WYPE (SM)
4	GMM	WDC	A4A116	WYPE (SZSP)
5	GMM	WDC	A4A117	WYPE (RVSP)
6	GMM	WDC	A4A118	WYPE (TJMD)
7	GMM	WDC	A4A119	WYPE (AS)
8	GMM	WDC	A4A1120	WYPE (TAMD)

CARD	TYPE	EQUIP	LOCATION	CIRCUIT
1	HFC	WDC	A4A325	MPU
2	HFC	FCC	A7A47	MPU
1	HFD	FCC	A7A5	MPU
1	JDB	NONE USED		
1	JHD	FCC	A1A36	TOTE REFRESH
2	JHD	FCC	A1A37	TOTE TIMING
3	JHD	FCC	A6A25	NSI/COC
4	JHD	FCC	A6A43	MEM
5	JHD	FCC	A6A44	MEM
6	JHD	FCC	A6A10	COC
7	JHD	FCC	A6A50	MEM
8	JHD	FCC	A6A12	NSI
9	JHD	FCC	A6A13	NSI
10	JHD	FCC	A6A14	VCC
11	JHD	FCC	A6A30	MP
12	JHD	CDC	A3A209	MP
13	JHD	CDC	A3A210	MP
14	JHD	CDC	A3A211	MP
15	JHD	CDC	A3A212	MP
16	JHD	CDC	A3A213	MP
17	JHD	CDC	A3A214	MP
18	JHD	CDC	A3A215	MP
19	JHD	CDC	A3A216	MP
20	JHD	CDC	A3A217	MP
21	JHD	WDC	A4A42	SYPE/GYRO
22	JHD	WDC	A4A44	SYPE (S/D CONV)
23	JHD	WDC	A4A83	TLC (SIMU)
24	JHD	WDC	A4A102	SYPE (GYRO)
25	JHD	WDC	A4A104	SYPE (DEPTH)
26	JHD	WDC	A4A258	DRL
27	JHD	WDC	A4A259	DRL

CARD	TYPE	EQUIP	LOCATION	CIRCUIT
1	KBC	WDC	A4A101	SYPE (GYRO)
2	KBC	WDC	A4A105	SYPE (GYRO/DEPTH)
3	KBC	WDC	A4A103	SYPE (GYRO)
1	KDM	CDC	A3A170	RAG/KEY
1	KDN	CDC	A3A86	RAG/KEY
2	KDN	CDC	A3A87	RAG/KEY
3	KDN	CDC	A3A88	RAG/KEY
1	KMA	CDC	A3A235	SDCV
1	KMB	FCC	A7AA86	WDC
2	KMB	CDC	A3A241	SVDC
3	KMB	CDC	A3A243	SVDC
4	KMB	CDC	A3A245	SDCV
5	KMB	CDC	A3A247	SDCV
6	KMB	CDC	A3A249	SDCV
7	KMB	CDC	A3A251	SDCV
8	KMB	CDC	A3A253	SDCV
9	KMB	CDC	A3A255	SDCV
10	KMB	CDC	A3A257	SDCV
11	KMB	CDC	A3A259	SDCV
12	KMB	CDC	A3A261	SDCV
13	KMB	CDC	A3A263	SDCV
14	KMB	CDC	A3A265	SDCV
15	KMB	CDC	A3A267	SDCV
16	KMB	CDC	A3A269	SDCV
1	KMC	CDC	A3A239	SDC
1	MDL	FCC	A7A84	WDC
2	MDL	FCC	A7A92	WDC
3	MDL	WDC	A4A156	TIMP (LEFT)
4	MDL	WDC	A4A157	TIMP (LEFT)
5	MDL	WDC	A4A355	TIMP (RIGHT)
6	MDL	WDC	A4A356	TIMP (RIGHT)

CARD	TYPE	EQUIP	LOCATION	CIRCUIT
1	MDM	FCC	A7A85	WDC
2	MDM	FCC	A7A93	WDC
3	MDM	WDC	A4A158	TIMP (LEFT)
4	MDM	WDC	A4A159	TIMP (LEFT)
5	MDM	WDC	A4A357	TIMP (RIGHT)
6	MDM	WDC	A4A358	TIMP (RIGHT)
1	MDP	FCC	A6A190	NS1
2	MDP	FCC	A6A191	NS1
3	MDP	FCC	A6A192	NS1
4	MDP	FCC	A6A193	NS1
5	MDP	FCC	A6A194	NS1
6	MDP	FCC	A6A193	NS
7	MDP	FCC	A7A194	NS
8	MDP	FCC	A7A195	NS
9	MDP	FCC	A7A196	NS
10	MDP	FCC	A7A197	NS
11	MDP	CDC	A3A97	NS1
12	MDP	CDC	A3A98	NS1
13	MDP	CDC	ADA99	NS1
14	MDP	CDC	A3100	NS1
15	MDP	CDC	A3101	NS1
16	MDP	CDC	A3A175	ATT/DIGS
17	MDP	CDC	A3A176	NS2
18	MDP	CDC	A3A177	NS2
19	MDP	CDC	13A178	NS2
20	MDP	CDC	A3A179	NS2
21	MDP	CDC	A3A180	NS2
22	MDP	CDC	A3A350	NS3
23	MDP	CDC	A3A351	NS3
24	MDP	CDC	A3A352	NS3
25	MDP	CDC	A3A353	NS3
26	MDP	FCC	A3A354	NS3
1	NFE	FCC	A6A72	19
2	NFE	FCC	A6A72	19
3	NFE	FCC	A6A74	19/DOC/COC
4	NFE	FCC	A6A15	NS1/19
5	NFE	FCC	A7A37	MP
6	NFE	FCC	A7A38	MP
7	NFE	FCC	A7A39	MP
8	NFE	FCC	A7A40	MP
9	NFE	FCC	A7A75	MP
10	NFE	FCC	A7A107	SWMX
11	NFE	FCC	A7A108	SWMX
12	NFE	CDC	A3A11	HMI/VMI
13	NFE	CDC	A3A112	SMI
14	NFE	CDC	A3A182	MP

CARD	TYPE	EQUIP	LOCATION	CIRCUIT
15	NFE	CDC	A3A183	MP
16	NFE	CDC	A3A184	MP
17	NFE	CDC	A3A185	MP
18	NFE	CDC	A3A186	MP
19	NFE	CDC	A3A230	MAMO
20	NFE	CDC	A3A231	MAMO
21	NFE	CDC	A3A358	MTI
22	NFE	CDC	A3A359	PTI
23	NFE	CDC	A3A360	PTI
24	NFE	WDC	A4A162	TSMF
25	NFE	WDC	A4A163	TSM/MIIF
26	NFE	WDC	A4A204	MIIF
27	NFE	WDC	A4A286	TWMK
28	NFE	WDC	A4A293	TIC/MIIF
29	NFE	WDC	A4A294	TIC
30	NFE	WDC	A4A298	TIC
31	NFE	WDC	A4A416	TIMP
32	NFE	WDC	A4A417	TIMP
33	NFE	WDC	A4A418	TIMP
34	NFE	WDC	A4A419	TIMP
1	NFM	FCC	A1A33	TOTE TIMING
2	NFM	FCC	A6A11	COC
3	NFM	FCC	A6A12	COC
4	NFM	FCC	A6A45	MEM
5	NFM	FCC	A6A46	MEM
6	NFM	FCC	A6A56	COC
7	NFM	FCC	A7A91	WDC
8	NFM	FCC	A7A121	INDC
9	NFM	FCC	A7A122	INDC
10	NFM	FCC	A7A123	INDC
11	NFM	FCC	A7A124	INDC
12	NFM	FCC	A7A125	INDC
13	NFM	FCC	A7A126	INDC
14	NFM	FCC	A7A127	INDC
15	NFM	FCC	A7A128	INDC
16	NFM	FCC	A7A129	INDC
17	NFM	FCC	A7A130	INDC
18	NFM	FCC	A7A131	INDC
19	NFM	FCC	A7A132	INDC
20	NFM	CDC	A3A10	ID1
21	NFM	CDC	A3A11	ID1
22	NMF	CDC	A3A12	ID1
23	NFM	CDC	A3A13	ID1
24	NFM	CDC	A3A14	ID1
25	NFM	CDC	A3A16	ID1
26	NFM	CDC	A3A17	ID1
27	NFM	CDC	A3A18	ID1
28	NFM	CDC	A3A19	ID1

CARD	TYPE	EQUIP	LOCATION	CIRCUIT
29	NFM	CDC	A3A22	PRT
30	NFM	WDC	AFA38	WYWG (TONE)
31	MFM	WDC	A4A25	MIIF
32	MFM	WDC	A4A88	TLC (SIMV)
33	MFM	WDC	A4A91	WYWG (LEFT)
34	MFM	WDC	A4A92	WYWG (LEFT)
35	MFM	WDC	A4A93	WYWG (LEFT)
36	MFM	WDC	A4A100	SYPE (GYRO)
37	NFM	WDC	A4A108	WYPE (MULTI)
38	NFM	WDC	A4A109	WYPE (MULTI)
39	NFM	WDC	A4A110	WYPE (MULTI)
40	NFM	WDC	A4A116	SYPE (DEPTH)
41	NFM	WDC	A4A151	WYWG (RIGHT)
42	NFM	WDC	A4A152	WYWG (RIGHT)
43	NFM	WDC	A4A153	WYWG (RIGHT)
44	NFM	WDC	A4A154	WYWG/RIGHT/LEFT)
45	NFM	WDC	A4A164	MIIF
46	NFM	WDC	A4A165	TSMF (PEPD/PEGA)
47	NFM	WDC	A4A166	TSMF (PETU/PEWY)
48	NFM	WDC	A4A167	TSMF (WYAG)
49	NFM	WDC	A4A168	MIIF
50	NFM	WDC	A4A169	TSMF (SLFI/FISJ)
51	NFM	WDC	A4A170	MIIF
52	NFM	WDC	A4A212	TIC (TUBE 1)
53	NFM	WDC	A4A213	TIC (TUBE 2)
54	NFM	WDC	A4A214	TIC (TUBE 3)
55	NFM	WDC	A4A215	TIC (TUBE 4)
56	NFM	WDC	A4A216	TIC (TUBE 5)
57	NFM	WDC	A4A217	TIC (TUBE 6)
58	NFM	WDC	A4A350	TIMP (LEFT)
59	NFM	WDC	A4A410	TIMP (RIGHT)
60	NFM	WDC	A4A411	TIMP
61	NFM	WDC	A6A183	NS1
1	NHF	FCC	A6A152	NS1
2	NHF	FCC	A6A153	NS1
3	NHF	FCC	A6A154	NS1
4	NHF	FCC	A7A190	NS
5	NHF	FCC	A7A191	NS
6	NHF	FCC	A7A192	NS
7	NHF	CDC	A3A78	NS2
8	NHF	CDC	A3A79	
9	NHF	CDC	A3A80	NS2
10	NHF	CDC	A3A81	NS2
11	NHF	CDC	A3A82	NS2
12	NHF	CDC	A3A83	NS2
13	NHF	CDC	A3A84	SZR
14	NHF	CDC	A3A85	SZR
15	NHF	CDC	A3A106	NS1

CARD	TYPE	EQUIP	LOCATION	CIRCUIT
16	NHF	CDC	A3A107	NS1
17	NHF	CDC	A3A108	NS1
18	NHF	CDC	A3A355	NS3
19	NHF	CDC	A3A356	NS3
20	NHF	CDC	A3A357	NS3
1	RFL	FCC	A7A97	INDC
2	RFL	FCC	A7A98	INDC
3	RFL	FCC	A7A99	INDC
4	RFL	FCC	A7A100	INDC
5	RFL	CDC	A3A26	ID1
6	RFL	CDC	A3A118	HMI
7	RFL	CDC	A3A194	ID1
8	RFL	CDC	A3A200	ID1
1	RHF	FCC	A6A17	IG/COC/VCC
2	RHF	FCC	A6A21	DOC/COC/VCC
3	RHF	FCC	A6A28	DOC/VCC
4	RHF	FCC	A6A32	NS1/IG/VCC
5	RHF	FCC	A6A33	VCC
6	RHF	FCC	A6A62	DOC
7	RHF	FCC	A6A70	IG
8	RHF	FCC	A6A101	IG/CG/DOC
9	RHF	FCC	A6A103	NS1/IG
10	RHF	FCC	A6A106	IG
11	RHF	FCC	A6A145	IG
12	RHF	FCC	A6A146	IG
13	RHF	FCC	A6A148	NS1/IG/MEM
14	RHF	FCC	A6A188	NS1
15	RHF	FCC	A7A4	MPU
16	RHF	FCC	A6A25	MON/MP
17	RHF	FCC	A6A27	MP/SWMX
18	RHF	FCC	A7A50	MPU
19	RHF	FCC	A7A57	MPU
20	RHF	FCC	A7A66	MP
21	RHF	FCC	A7A87	WDC
22	RHF	FCC	A7A141	INDC
23	RHF	FCC	A7A142	DMCO/INDC
24	RHF	FCC	A7A181	INDC
25	RHF	FCC	A7A182	INDC
26	RHF	FCC	A7A183	INDC
27	RHF	FCC	A7A184	INDC
28	RHF	FCC	A7A185	INDC
29	RHF	FCC	A7A187	NS
30	RHF	CDC	A3A23	SMI
31	RHF	CDC	A3A105	HMI/NS1
32	RHF	CDC	A3A116	HMI/VMI
33	RHF	CDC	A3A128	MPU1

CARD	TYPE	EQUIP	LOCATION	CIRCUIT
1	RHF	CDC	A3A135	MPU1
2	RHF	CDC	A3A152	MPU2
3	RHF	CDC	A3A159	MPU2
4	RHF	CDC	A3A167	NS2
5	RHF	CDC	A3A196	MP
6	RHF	CDC	A3A197	MP
7	RHF	CDC	A3A199	MP
8	RHF	CDC	A3A202	MP
9	RHF	CDC	A3A220	CLK
10	RHF	CDC	A3A229	MAMO
11	RHF	CDC	A3A238	SDCV
12	RHF	CDC	A3A309	MON
13	RHF	CDC	A3A331	MTI
14	RHF	CDC	A3A342	MTI
15	RHF	CDC	A3A346	NS3
16	RHF	CDC	A3A39	SYPE/WYWG
17	RHF	WDC	A4A79	TLC (RIGHT)
18	RHF	WDC	A4A80	TLC (RIGHT/LEFT)
19	RHF	WDC	A4A81	TLC (LEFT)
20	RHF	WDC	A4A82	TLC (RIGHT/LEFT)
21	RHF	WDC	A4A252	TLC/DDL
22	RHF	WDC	A4A346	TIMP
23	RHF	WDC	A4A347	TIMP (LEFT)
24	RHF	WDC	A4A348	TIMP (RIGHT)
25	RHF	WDC	A4A349	TIMP/MPU
26	RHF	WDC	A4A385	MPU
27	RHF	WDC	A4A392	MPU
28	RHF	WDC	A4A408	TIMP
29	RHF	FCC	A6A357	DOC/MEM/COC
30	RHF	FCC	A6A59	DOC/MEM
31	RHF	FCC	A6A14	COC
1	RHG	FCC	A6A16	DOC/MEM/COC
2	RHG	FCC	A6A31	CG/DOC/VCC
3	RHG	FCC	A6A55	COC/VCC
4	RHG	FCC	A6A64	CG/DOC
5	RHG	FCC	A6A02	IG/DOC/MEM
6	RHG	FCC	A6A144	IG/MEM
7	RHG	FCC	A6A147	NSJ/IG/VCC
8	RHG	FCC	A6A187	NSI/IG/MEM
9	RHG	FCC	A7A24	MON/MP
10	RHG	FCC	A7A89	WDC
11	RHG	FCC	A7A104	MP/SWMX
12	RHG	FCC	A7A106	SWMX
13	RHG	FCC	A7A137	INDC
14	RHG	FCC	A7A138	INDC
15	RHG	FCC	A7A139	DMCO/INDC
16	RHG	CDC	A3A9	HMI/VMI/PRT/IDI
17	RHG	CDC	A3A114	HMI/VMI

CARD	TYPE	EQUIP	LOCATION	CIRCUIT
(1)	RHG	CDC	A3A203	MP
18	RHG	CDC	A3A306	MON
19	RHG	WDC	A4A41	SYPE/WYWG
20	RHG	WDC	A4A43	SYPE (GYRO/DEPTH)
21	RHG	WDC	A4A46	SYPE/WYPE
22	RHG	WDC	A4A95	WYWG
23	RHG	WDC	A4A136	TLC (RIGHT)
24	RHG	WDC	A4A137	TLC (RIGHT/LEFT/SIMU)
25	RHG	WDC	A4A138	TLC (LEFT)
26	RHG	WDC	A4A139	TLC
27	RHG	WDC	A4A249	PWMN/MPU
28	RHG	WDC	A4A297	TIMP/TIC
29	RHG	WDC	A4A345	TIMP
30	RHG	WDC	A4A405	TIMP
31	RHG	WDC	A4A407	TIMP
32	RHG	CDC	A3A201	MP
1	RMB	FCC	A7194	NDC
2	RMB	CDC	A3A89	RAG
3	RMB	CDC	A3A90	RAG/KEY
4	RMB	WDC	A4A98	TIMP (LEFT)
5	RMB	WDC	A4A359	TIMP (RIGHT)
6	RMB	WDC	A4A359	TIMP (RIGHT)
7	RMB	WDC	A4A360	TIMP (RIGHT)
1	RQA	FCC	A7A31	MP
2	RQA	FCC	A7A32	MP
3	RQA	CDC	A3A25	SMI
4	RQA	CDC	A3A205	MP
5	RQA	CDC	A3A206	MP
6	RQA	WDC	A4A287	TWMK
7	RQA	WDC	A4A288	TWMK
8	RQA	WDC	A4A289	TIMP
9	RQA	WDC	A4A295	TIMP/TIC
10	RQA	WDC	A4A414	TIMP
11	RQA	FCC	A7A101	DMCO
12	RQA	FCC	A7A102	SWMX
13	RQA	FCC	A7A103	SWMX
1	RRF	FCC	A7A95	WDC
2	RRF	CDC	A3A171	MAMO
3	RRF	CDC	A3A173	MAMO
4	RRF	WDC	A4A160	MIIF
5	RRF	WDC	A4A181	MIIF
6	RRF	WDC	A4A183	MIIF
7	RRF	WDC	A4A185	MIIF
8	RRF	WDC	A4A187	MIIF

CARD	TYPE	EQUIP	LOCATION	CIRCUIT
9	RRF	WDC	A4A189	MIIF
10	RRF	WDC	A4A191	MIIF
11	RRF	WDC	A4A193	MIIF
12	RRF	WDC	A4A195	MIIF
13	RRF	WDC	A4A197	MIIF
14	RRF	WDC	A4A199	MIIF
15	RRF	WDC	A4A201	MIIF
16	RRF	WDC	A4A203	MIIF
17	RRF	WDC	A4A206	MIIF
18	RRF	WDC	A4A208	MIIF
19	RRF	WDC	A4A225	TIC
20	RRF	WDC	A4A227	TIC
21	RRF	WDC	A4A229	TIC
22	RRF	WDC	A4A231	TIC
23	RRF	WDC	A4A233	TIC
24	RRF	WDC	A4A235	TIC
25	RRF	WDC	A4A237	TIC
26	RRF	WDC	A4A239	TIC
27	RRF	WDC	A4A272	TWMK
28	RRF	WDC	A4A274	TWMK
29	RRF	WDC	A4A276	TWMK
30	RRF	WDC	A4A284	TIMP/TWMK/MIIF
31	RRF	WDC	A4A291	TIMP
32	RRF	WDC	A2A27	TOAD
33	RRF	WDC	A2A29	TOAD
34	RRF	WDC	A4A111	TSMF
1	SHU	CDC	A3A233	SDCV
1	SHY	CDC	A3A234	SDCV
1	TSS	FCC	A7A140	MON
2	TSS	CDC	A3A310	MON
3	TSS	WDC	A4A251	PWMN
4	TSS	TOAD	A2A34	TOAD
1	UPW	FCC	A6A161	POWER SUPPLY
2	UPW	FCC	A7A161	POWER SUPPLY
3	UPW	CDC	A3A411	POWER SUPPLY
4	UPW	CDC	A3A361	POWER SUPPLY
5	UPW	CDC	A3A431	POWER SUPPLY
6	UPW	WDC	A4A1	POWER SUPPLY
7	UPW	WDC	A4A461	POWER SUPPLY

FCC CARD LOCATIONS

LOCATION	CARD TYPE	CIRCUIT
A1A1	-	Vacant
A2	-	Vacant
A3	CMC	Column/Line Select Drivers
A4	CMC	Column/Line Select Drivers
A5	CMC	Column/Line Select Drivers
A6	CMC	Column/Line Select Drivers
A7	CMC	Column/Line Select Drivers
A8	CMC	Column/Line Select Drivers
A9	CMC	Column/Line Select Drivers
A10	CMC	Column/Line Select Drivers
A11	CMC	Column/Line Select Drivers
A12	CMC	Column/Line Select Drivers
A13	CMC	Column/Line Select Drivers
A14	CMC	Column/Line Select Drivers
A15	CMC	Column/Line Select Drivers
A16	CMC	Column/Line Select Drivers
A17	CMC	Column/Line Select Drivers
A18	CMC	Column/Line Select Drivers
A19	-	Vacant
A20	FFG	Tote Dimming
A21	EJC	Tote Timing/Dimming
A22	-	Vacant
A23	AFA	Tote Timing
A24	AFA	Tote Timing
A25	FVC	Tote Timing
A26	-	Vacant
A27	FEA	Tote Timing
A28	FEA	Tote Timing
A29	FEA	Tote Timing/Refresh
A30	EHK	Tote Timing/Refresh/Dimming
A31	GHK	Tote Timing
A32	GHK	Tote Timing
A33	NFM	Tote Timing
A34	DRM	Tote Refresh
A35	EYA	Tote Refresh
A36	JHD	Tote Refresh
A37	JHD	Tote Timing/Refresh
A38	BHA	Tote Refresh
A39	DRL	Tote Refresh
A40	FMF	Tote
A3A2A1	L535 300 515	Power Supply
A2	-	Vacant
A3	-	Vacant
A4	L535 300 276	Phosphor Protect
A5	L535 300 282	Focus Supply
A6	L414 000 127	Focus Amplifier
A7	L535 300 281	Video D/A & Gamma Correction

LOCATION	CARD TYPE	CIRCUIT
A3A2A8	L535 300 261	Cathode Video Amplifier
A9	L535 300 262	Grid Video Amplifier
A10	L535 300 285	Minor D/A (Horizontal)
A11	L535 300 285	Minor D/A (Vertical)
A12	L535 300 281	Linearity Corrector
A13	L535 300 263	Sum Amplifier
A14	L535 300 260	D/A Convertor (Horizontal)
A15	L535 300 260	D/A Convertor (Vertical)
A3A3	L414 000 125	Major Deflection Amplifier (Vertical)
A3A4	L414 000 125	Major Deflection Amplifier (Horizontal)
A6A1	DRM	COC
A2	DRM	COC
A3	DRM	COC
A4	DRM	COC
A5	DRM	COC
A6	DRM	COC
A7	DRM	COC
A8	DRM	COC
A9	FEA	COC
A10	JHD	COC
A11	NFM	COC
A12	NFM	COC
A13	CHH	COC
A14	RHF	COC
A15	CHH	COC
A16	RHG	DOC/MEM/COC
A17	RHF	IG/COC/COC
A18	CHH	IG/DOC/COC
A19	FEA	COC
A20	BHA	COC
A21	RHF	DOC/COC/VCC
A22	FEA	CG
A23	FEA	COC
A24	CHH	IG/COC/VCC
A25	JHD	NSI/COC
A26	BHL	VCC
A27	BHL	VCC
A28	RHF	DOC/VCC
A29	BHL	VCC
A30	FEA	VCC
A31	RHG	CG/DOC/VCC
A32	RHF	NSI/IG/VCC
A33	RHF	VCC
A34	-	Vacant
A35	-	Vacant
A36	-	Vacant

LOCATION	CARD TYPE	CIRCUIT
A6A37	-	Vacant
A38	-	Vacant
A39	-	Vacant
A40	-	Vacant
A41	FEA	MEM
A42	FEA	MEM
A43	JHD	MEM
A44	JHD	MEM
A45	NFM	MEM
A46	NFM	MEM
A47	EHK	MEM
A48	EHK	NSI/MEM
A49	DRL	MEM/COC
A50	JHD	MEM
A51	DRL	MEM
A52	DRL	MEM
A53	DRL	MEM
A54	GHK	IG/COC
A55	RHG	COC/VCC
A56	NFM	COC
A57	RHF	DOC/MEM/COC
A58	CHH	IG/DOC
A59	RHF	DOC/MEM
A60	GHK	DOC
A61	CHH	DOC
A62	RHF	DOC
A63	CHH	DOC
A64	RHG	CG/DOC
A65	EHK	NSI/CG/MEM/VCC
A66	EHK	VCC
A67	FEA	CG
A68	CHH	IG/DOC
A69	CHH	IG/DOC/COC
A70	RHF	IG
A71	BHA	IG
A72	NFE	IG
A73	NFE	IG
A74	NFE	IG/DOC/COC
A75	-	Vacant
A76	-	Vacant
A77	-	Vacant
A78	-	Vacant
A79	-	Vacant
A80	-	Vacant
A81	EYA	MEM
A82	EYA	MEM
A83	EYA	MEM
A84	EYA	MEM
A85	EYA	MEM
A86	EYA	MEM
A87	EYA	MEM

LOCATION	CARD TYPE	CIRCUIT
A6A88	EYA	MEM
A89	EYA	MEM
A90	EYA	MEM
A91	EYA	MEM
A92	EYA	MEM
A93	EYA	MEM
A94	EYA	MEM
A95	EYA	MEM
A96	EYA	MEM
A97	AFA	IG/MEM
A98	FEA	IG/COC
A99	BHL	IG
A100	FEA	COC
A101	RHF	IG/CG/DOC
A102	RHG	IG/DOC/MEM
A103	RHF	NSI/IG
A104	GHK	IG
A103	CHH	IG
A104	GHK	IG
A105	CHH	IG
A106	RHF	IG
A107	CHH	IG
A108	CHH	IG
A109	GHK	IG
A110	FMF	NSI/IG
A111	EHK	IG/VCC
A112	JHD	NSI
A113	JHD	NSI
A114	JHD	VCC
A115	-	Vacant
A116	-	Vacant
A117	-	Vacant
A118	-	Vacant
A119	-	Vacant
A120	-	Vacant
A121	-	Vacant
A122	-	Vacant
A123	-	Vacant
A124	-	Vacant
A125	-	Vacant
A126	-	Vacant
A127	-	Vacant
A128	-	Vacant
A129	-	Vacant
A130	-	Vacant
A131	-	Vacant
A132	-	Vacant
A133	-	Vacant
A134	-	Vacant
A135	-	Vacant
A136	-	Vacant
A137	DRL	MEM

LOCATION	CARD TYPE	CIRCUIT
A138	DRL	MEM
A139	BHA	IG
A140	BHA	IG
A141	BHL	IG
A142	FEA	CG
A143	CHH	IG
A144	RHG	IG/MEM
A145	RHF	IG
A146	RHF	IG
A147	RHG	NSI/IG/VCC
A148	RHF	NSI/IG/MEM
A149	GHK	NSI/IG/MEM
A150	EHK	NSI
A151	NFE	NSI/IG
A152	NHF	NSI
A153	NHF	NSI
A154	NHF	NSI
A155	-	Vacant
A156	-	Vacant
A157	-	Vacant
A158	-	Vacant
A159	-	Vacant
A160	-	Vacant
A161	UPW	)
A162	*	)
A163	*	)
A164	*	)
A165	*	)
A166	*	)
A167	*	)
A168	*	)
A169	*	)
A170	*	)
A171	*	)
A172	*	) Power Supply
A173	*	)
A174	*	)
A175	*	)
A176	*	)
A177	*	)
A178	*	)
A179	*	)
A180	*	)
A181	FEA	IG
A182	FEA	IG/MEM
A183	NFM	NSI
A184	DRL	MEM
A185	DRL	MEM
A186	CHH	NSI/IG
A187	RHG	NSI/IG/MEM
A188	RHF	NSI

LOCATION	CARD TYPE	CIRCUIT
A6A189	GHK	NSI
A190	MDP	NSI
A191	MDP	NSI
A192	MDP	NSI
A193	MDP	NSI
A194	MDP	NSI
A195	EHK	NSI
A196	FMF	NSI
A197		Vacant
A198		Vacant
A199		Vacant
A200		Vacant
A7A1	DRN	MPU
A2	DRN	MPU
A3	BJJ	MPU
A4	RHF	MPU
A5	HFD	MPU
A6	FQR	MPU
A7	FQR	MPU
A8	FQR	MPU
A9	FQR	MPU
A10	EHK	MPU
A11	BJJ	MPU
A12	BJJ	MPU
A13	BJJ	MPU
A14	BJJ	MPU
A15	BJJ	MPU
A16	BJJ	MPU
A17	BJJ	MPU
A18	BJJ	MPU
A19	BJJ	MPU (SECONDARY MODE PROM)
A20	DRN	MPU
A21	DRN	MPU
A22	DRN	MPU
A23	DRN	MPU
A24	RHG	MON/MP
A25	RHF	MON/MP
A26	EHK	MP
A27	RHF	MP/SWMX
A28	BHL	MP
A29	CHH	MP
A30	JHD	MP
A31	RQA	MP
A32	RQA	MP
A33	EHK	MP
A34	EHK	MP
A35		Vacant
A36		Vacant
A37	NFE	MP

LOCATION	CARD TYPE	CIRCUIT
A7A38	NFE	MP
A39	NFE	MP
A40	NFE	MP
A41	-	Vacant
A42	-	Vacant
A43	DRN	MPU
A44	DRN	MPU
A45	BJJ	MPU
A46	DRJ	MPU/MON
A47	HFC	MPU
A48	DRL	MPU
A49	DRL	MPU
A50	RHF	MPU
A51	-	Vacant
A52	FQM	MPU
A53	DRL	MPU
A54	EHK	MPU
A55	AFA	MPU
A56	AFA	MPU
A57	RHF	MPU
A58	DRL	MPU
A59	DRL	MPU
A60	DRN	MPU
A61	DRN	MPU
A62	DRN	MPU
A63	DRN	MPU
A64	CHP	MON/SWMX
A65	-	Vacant
A66	RHF	MP
A67	GHK	MP/WDC
A68	RHG	MP/MPU
A69	-	Vacant
A70	-	Vacant
A71	EJC	MP
A72	EHK	MP
A73	EHK	MP
A74	EHK	MP
A75	NFE	MP
A76	DRL	TIF
A77	FMF	NON/TIF
A78	-	) Ribbon
A79	-	) Cable
A80	-	) Plugs
A81	-	Vacant
A82	-	Vacant
A83	-	Vacant
A84	MDL	WDC
A85	MDM	WDC
A86	RMB	WDC
A87	RHF	WDC
A88	CHH	WDC

LOCATION	CARD TYPE	CIRCUIT
A89	RHG	WDC
A90	FEA	WDC
A91	NFM	WDC
A92	MDL	WDC
A93	MDM	WDC
A94	RMB	WDC
A95	RRF	WDC
A96	*	"
A97	RFL	INDC
A98	RFL	INDC
A99	RFL	INDC
A100	RFL	INDC
A101	RQA	DMCO
A102	RQA	SWMX
A103	RQA	SWMX
A104	RHG	MP/SWMX
A105	CHH	SWMX
A106	RHG	SWMX
A107	NFE	SWMX
A108	NFE	SWMX
A109	EHK	SWMX
A110	-	Vacant
A111	-	Vacant
A112	FEA	DMCO
A113	FEA	DMCO
A114	FFG	DMCO
A115	FFG	MON
A116	FFG	MON
A117	FFG	MON
A118	-	) Ribbon
A119	-	) Cable
A120	-	Plugs
A121	NFM	INDC
A122	NFM	INDC
A123	NFM	INDC
A124	NFM	INDC
A125	NFM	INDC
A126	NFM	INDC
A127	NFM	INDC
A128	NFM	INDC
A129	NFM	INDC
A130	NFM	INDC
A131	NFM	INDC
A132	NFM	INDC
A133	AFA	INDC
A134	AFA	INDC
A135	EHK	INDC
A136	EHK	INDC
A137	RHG	INDC
A138	RHG	INDC
A139	RHG	DMCO/INDC

LOCATION	CARD TYPE	CIRCUIT
A7A140	TSS	MON
A141	RHF	INDC
A142	RHF	DMCO/INDC
A143	-	Vacant
A144	EJC	MP
A145	EJC	WDC/INDC
A146	EJC	INDC
A147	EJC	INDC
A148	EHC	INDC
A149	EJC	INDC
A150	EJC	INDC
A151	EJC	INDC
A152	EJC	INDC
A153	EJC	INDC
A154	EJC	INDC
A155	EJC	INDC
A156	EJC	INDC
A157	EJC	INDC
A158	-	Vacant
A159	-	) Ribbon Cable
A160	-	) Plugs
A161	UPW	)
A162	*	)
A163	*	)
A164	*	)
A165	*	)
A166	*	)
A167	*	)
A168	*	)
A169	*	)
A170	*	)
A171	*	)
A172	*	) Power Supply 5V
A173	*	)
A174	*	)
A175	*	)
A176	*	)
A177	*	)
A178	*	)
A179	*	)
A180	*	)
A181	RHF	INDC
A182	RHF	INDC
A183	RHF	INDC
A184	RHF	INDC
A185	RHF	INDC
A186	EHK	INDC
A187	RHF	NS
A188	FEA	NS
A189	FEA	NS
A190	NHF	NS

LOCATION	CARD TYPE	CIRCUIT
A7A191	NHF	NS
A192	NHF	NS
A193	MDP	NS
A194	MDP	NS
A195	MDP	NS
A196	MDP	NS
A197	MDP	NS
A198	-	) Ribbon
A199	-	) Cable
A200	- -	) Plugs
A8A1	FPN	REG 12V
A2	-	Power Supply 12V
A3	-	Power Supply 12V
A4	-	-
A5	-	-
A6	-	-
A7	-	Transistor power pack
A8	UPW	Power Supply 5V
A9	-	Power Supply 5V
A10	UPW	Power Supply 5V

TOAD CARD LOCATIONS

LOCATION	CARD TYPE	CIRCUIT
A2A1	-	Vacant
A2	-	Vacant
A3	-	Vacant
A4	-	Vacant
A5	-	Vacant
A6	-	Vacant
A7	-	Vacant
A8	ABE	TOAD
A9	FRD	
A10	*	TOAD
A11	FRD	
A12	*	TOAD
A13	-	Vacant
A14	-	Vacant
A15	-	Vacant
A16	-	Vacant
A17	-	Vacant
A18	-	Vacant
A19	-	Vacant
A20	-	Vacant
A21	-	Vacant
A22	-	Vacant
A23	-	Vacant
A24	-	Vacant
A25	-	Vacant
A26	ABE	TOAD
A27	RRF	TOAD
A28	*	
A29	RRF	TOAD
A30	*	
A31	FFG	TOAD
A32	FFG	TOAD
A33	-	Vacant
A34	TSS	TOAD
A35	-	Vacant
A36	-	Vacant
A37	-	Vacant
A38	-	Vacant
A39	-	Vacant
A40	-	Vacant
A41	-	Vacant
A42	-	Vacant
A43	-	Vacant
A44	-	Vacant
A45	-	Vacant
A46	-	Vacant
A47	-	Vacant
A48	-	Vacant
A49	-	Vacant

LOCATION	CARD TYPE	CIRCUIT
A2A50	-	Vacant
A51	-	Vacant
A52	-	Vacant
A53	-	Vacant
A54	-	Vacant
A55	-	Vacant
A56	-	Vacant
A57	-	Vacant
A58	-	Vacant
A59	-	Vacant
A60	-	Vacant
A61	-	Vacant
A62	-	Vacant
A63	-	Vacant
A64	-	Vacant

WDC CARD LOCATIONS

LOCATION	CARD TYPE	CIRCUIT
A2A1	414 000 131	WYWG
A2	414 000 131	WYWG
A3	414 000 132	WYMG
A4	414 000 130	TSMF
A5	-	Vacant
A6	-	Vacant
A7	-	Vacant
A8	414 000 129	SYPE
A9	414 000 129	SYPE
A10	414 000 133	TSMF
A11	535 300 518	Power Supply
A3A1	535 300 517	TLC
A2	535 300 519	TLC
A3	535 300 522	TLC
A4	535 300 517	TLC
A5	535 300 519	TLC
A6	535 300 522	TLC
A7	-	Vacant
A8	-	Vacant
A9	-	Vacant
A10	-	Vacant
A11	535 300 508	WYWG
A12	535 300 520	WYWG
A13	535 300 520	WYWG
A14	535 300 503	WYPE
A15	535 300 504	WYPE
A16	535 300 520	SYPE
A17	535 300 520	SYPE
A18	535 300 505	SYPE
A19	535 300 859	MIIF
A20	535 300 859	MIIF
A21	535 300 859	MIIF
A22	535 300 859	MIIF
A23	535 300 859	MIIF
A24	535 300 859	MIIF
A25	535 300 859	MIIF
A4A1	UPW	)
A2	*	)
A3	*	)
A4	*	)
A5	*	) Power Supply
A6	*	)
A7	*	)
A8	*	)
A9	*	)

LOCATION	CARD TYPE	CIRCUIT
A4A10	*	)
A11	*	) Power Supply
A12	*	)
A13	*	)
A14	*	)
A15	*	)
A16	*	)
A17	*	)
A18	*	)
A19	*	)
A20	*	)
A21	FVC	WYWG
A22	FVC	WYWG
A23	FVC	Vacant
A24	NFM	MIIF
A25	NFM	MIIF
A26	EJC	Vacant
A27	EJC	Vacant
A28	EJC	Vacant
A29	-	Vacant
A30	-	Vacant
A31	BJJ	WYWG
A32	BJJ	WYWG
A33	FEA	WYWG (RIGHT)
A34	FEA	WYWG (LEFT)
A35	GHK	WYWG
A36	CHH	TLC/WYWG
A37	FEA	WYWG (TONE)
A38	NFM	WYWG (TONE)
A39	RHF	SYPE//WYWG
A40	GHK	SYPE
A41	RHG	SYPE/WYWG)
A42	JHD	SYPE/GYRO
A43	RHG	SYPE (GYRO/DEPTH)
A44	JHD	SYPE (S/D CONV)
A45	CHP	SYPE
A46	RHG	SYPE/WYPE
A47	GKR	WYPE(RNFN)
A48	*	
A49	GKR	
A50	*	
A51	GKR	WYPE (FG)
A52	*	
A53	GKR	WYPE (SD)
A54	*	
A55	GKR	WYPE (CGOFF)
A56	*	
A57	GKR	
A58	*	
A59	GKR	WYPE (AM)
A60	*	
A61	FPM	

LOCATION	CARD TYPE	CIRCUIT
A4A62	*	)
A63	*	)
A64	*	)
A65	*	)
A66	*	)
A67	*	)
A68	*	) Power Supply
A69	*	)
A70	*	)
A71	*	)
A72	*	)
A73	*	)
A74	*	)
A75	*	)
A76	*	)
A77	AFA	TLC
A78	CHH	FLC
A79	RHF	TLC (RIGHT)
A80	RHF	TLC (LEFT)
A81	RHF	TLC (LEFT/SIMU)
A82	RHF	TLC (LEFT/SIMU)
A83	JHD	TLC(SIMU)
A84	EJC	TLC
A85	EHL	TLC
A86	GHK	TLC (RIGHT)
A87	GHK	TLC (LEFT)
A88	NFM	TLC (SIMU)
A89	-	Vacant
A90	-	Vacant
A91	NFM	WYWG (LEFT)
A92	NFM	WYWG (LEFT)
A93	NFM	WYWG (LEFT)
A94	GBP	WYWG (LEFT)
A95	RHG	WYWG
A96	GHK	WYWG (TONE)
A97	GHK	WYWG (TONE)
A98	RMB	TIMP (LEFT)
A99	RMB	TIMP (LEFT)
A100	NFM	SYPE (GYRO)
A101	KBC	SYPE (GYRO)
A102	JHD	SYPE (GYRO)
A103	KBC	SYPE (GYRO)
A104	JHD	SYPE (DEPTH)
A105	KBC	SYPE (GYRO/DEPTH)
A106	NFM	SYPE (DEPTH)
A107	-	Vacant
A108	NFM	WYPE (MULTI)
A109	NFM	WYPE (MULTI)
A110	NFM	WYPE (MULTI)
A111	RRF	TSMF
A112	*	
A113	GMM	WYPE (PU)

LOCATION	CARD TYPE	CIRCUIT
A4A114	GMM	WYPE (DOEN)
A115	GMM	WYPE (SM)
A116	GMM	WYPE (SZSP)
A117	GMM	WYPE (RUSP)
A118	GMM	WYPE (TJMD)
A119	GMM	WYPE (AS)
A120	GMM	WYPE (TAMD)
A121	FPM	)
A122	*	)
A1	*	)
A2	*	)
A3	*	)
A4	*	)
A5	*	)
A6	*	)
A7	*	) Power Supply
A8	*	)
A9	*	)
A10	*	)
A11	*	)
A12	*	)
A13	*	)
A14	*	)
A15	RHG	TLC (RIGHT)
A16	RHG	TLC (RIGHT/LEFT/SIMU)
A17	RHG	TLC (LEFT)
A18	RHG	TLC/
A19	FEA	TLC (RIGHT)
A20	FEA	TLC (RIGHT)
A21	FEA	TLC (LEFT/SIMU)
A22	FEA	TLC (LEFT)
A23	FEA	TLC (SIMU)
A24	FEA	TLC (SIMU)
A25	FEA	TLC (SIMU)
A26	-	Vacant
A27	-	Vacant
A28	-	Vacant
A29	-	Vacant
A30	NFM	WYWG (RIGHT)
A31	NFM	WYWG (RIGHT)
A32	NFM	WYWG (RIGHT)
A33	NFM	WYWG (LEFT/RIGHT)
A34	-	Vacant
A35	MDL	TIMP (LEFT)
A36	MDL	TIMP (LEFT)
A37	MDM	TIMP (LEFT)
A38	MDM	TIMP (LEFT)
A39	RRF	MIIF
A40	*	
A41	NFE	TSMF
A42	NFE	TSMF (MIIF
A43	NFM	MIIF

LOCATION	CARD TYPE	CIRCUIT
A165	NFM	TSMF (PEPD/PEGA)
A166	NFM	TSMF (PETU/PEWY)
A167	NFM	TSMF (WYAG)
A168	NFM	MIIF
A169	NFM	TSMF (SLFI/FISJ)
A170	NFM	MIIF
A171	EJC	MIIF
A172	EJC	TSMF (PEPD/PEGA)
A173	EJC	TSMF (PETU/PEWY)
A174	EJC	TSMF (WYAG)
A175	EJC	MIIF
A176	EJC	TSMF (SLFI/FISJ)
A177	EJC	MIIF
A178	EJC	TSMF (TEST)/MIIF
A179	RRF	TSMF/MIIF
A180	*	
A181	RRF	MIIF
A182	*	
A183	RRF	MIIP
A184	*	
A185	RRF	MIIF
A186	*	
A187	RRF	MIIF
A188	*	
A189	RRF	MIIF
A190	*	
A191	RRF	MIIF
A192	*	
A193	RRF	MIIF
A194	*	
A195	RRF	MIIF
A196	*	
A197	RRF	MIIF
A198	*	
A199	RRF	MIIF
A200	*	
A201	RRF	MIIF
A202	*	
A203	RRF	MIIF
A204	*	
A205	NFE	MIIF
A206	RRF	MIIF
A207	*	
A208	RRF	MIIF
A209	*	
A210	-	Vacant
A211	ABE	TIC (Not shown on prints)
A212	NFM	TIC (TUBE 1)
A213	NFM	TIC (TUBE 2)
A214	NFM	TIC (TUBE 3)
A215	NFM	TIC (TUBE 4)
A216	NFM	TIC (TUBE 5)

LOCATION	CARD TYPE	CIRCUIT
A4A217	NFM	TIC (TUBE 6)
A218	EJC	TIC (TUBE 1)
A219	EJC	TIC (TUBE 2)
A220	EJC	TIC (TUBE 3)
A221	EJC	TIC (TUBE 4)
A222	EJC	TIC (TUBE 5)
A223	EJC	TIC (TUBE 6)
A224	EJC	TIMP/TIC
A225	RRF	TIC
A226	*	
A227	RRF	TIC
A228	*	
A229	RRF	TIC
A230	*&	
A231	RRF	TIC
A232	*	
A233	RRF	TIC
A234	*	
A235	RRF	TIC
A236	*	
A237	RRF	TIC
A238	*	
A239	RRF	TIC
A240	*	
A241	*	
A242	FPN	PWMN
A243	-	VACANT
A244	FFG	PWMN
A245	FFG	PWMN
A246	FFG	PWMN
A247	FFG	PWMN
A248	FFG	PWMN
A249	FFG	PWMN/MPU
A250	CHH	PWMN/MPU
A251	TSS	PWMN
A252	RHF	TIMP/DDL
A253	EHK	DDL
A254	EHK	DDL/DRL/PWMN
A255	AFA	DDL
A256	AFA	DDL
A257	AFA	DDL
A258	JHD	DRL
A259	JHD	DRL
A260	BHL	DRL (BIT 0)
A261	BHL	DRL (BIT 0 & 7)
A262	BHL	DRL (BIT 1 & 7)
A263	BHL	DRL (BIT 2)
A264	BHL	DRL (BIT 2 & 3)
A265	BHL	DRL (BIT 3 & 7)
A266	BHL	DRL (HIT 4)
A267	BHL	DRL (BIT 4 & 5)
A268	BHL	DRL (BIT 5)

LOCATION	CARD TYPE	CIRCUIT
A4A269	BHL	DRL (BIT 6)
A270	BHL	DRL (BIT 7)
A271	FMF	TWMK/PWMN/MIIF
A272	RRF	TWMK
A273	*	
A274	RRF	TWMK
A275	*	
A276	RRF	TWMK
A277	*	
A278	FFG	TWMK (TUBE 1)
A279	FFG	TWMK (TUBE 2)
A280	FFG	TWMK (TUBE 3)
A281	FFG	TWMK (TUBE 4)
A282	FFG	TWMK (TUBE 5)
A283	FFG	TWMK (TUBE 6)
A284	RRF	TIMP/TWMK/MIIF
A285	*	
A286	NFE	TWMK
A287	RQA	TWMK
A288	RQA	TWMK
A289	RQA	TIMP
A290	NFE	TIMP/TWMK
A291	RRF	TIMP
A292	*	
A293	NFE	TIC/MIIF
A294	NFE	TIC
A295	RQA	TIMP/TIC
A296	CHP	TIMP/TIC
A297	RHG	TIMP/TIC
A298	NFE	TIC
A299	FMF	TIC/TSMF/MIIF
A300	EHK	TIMP
A301	FPM	)
A302	*	)
A303	*	)
A304	*	)
A305	*	)
A306	*	)
A307	*	)
A308	*	) Power Supply
A309	*	)
A310	*	)
A311	*	)
A312	*	)
A313	*	)
A314	*	)
A315	*	)
A316	DRN	MPU
A317	DRN	MPU
A318	FQR	MPU
A319	FQR	MPU
A320	FQR	MPU

LOCATION	CARD TYPE	CIRCUIT
A4A321	FQR	MPU
A322	-	Vacant
A323	-	Vacant
A324	-	Vacant
A325	HFC	MPU
A326	BJJ	MPU
A327	-	Vacant
A328	-	Vacant
A329	BJJ	MPU
A330	BJJ	MPU
A331	BJJ	MPU
A332	-	Vacant
A333	-	Vacant
A334	-	Vacant
A335	DRN	MPU
A336	DRN	MPU
A337	DRN	MPU
A338	DRN	MPH
A339	EHK	NIIF
A340	EHK	TIMP
A341	EHK	TIMP
A342	DRJ	MPU/PWMN
A343	CHH	TIMP
A344	CHH	TIMP
A345	RHG	TIMP
A346	RHF	TIMP
A347	RHF	TIMP (LEFT)
A348	RHG	TIMP (RIGHT)
A349	RHF	TIMP/MPU
A350	NFM	TIME (LEFT)
A351	GHK	TIMP
A352	GHK	TIMP/MPU
A353	GHK	TIMP
A354	FEA	TIMP (RIGHT)
A355	MDL	TIMP (RIGHT)
A356	MDL	TIMP (TIGHT)
A357	MDM	TIMP (RIGHT)
A358	MDM	TIMP (RIGHT)
A359	RMB	TIMP (RIGHT)
A360	RMB	TIMP (RIGHT)
A361	-	Vacant
A362	-	Vacant
A363	-	Vacant
A364	-	Vacant
A365	-	Vacant
A366	-	Vacant
A367	-	Vacant
A368	-	Vacant
A369	-	Vacant
A370	-	Vacant
A371	-	Vacant
A372	-	Vacant

LOCATION	CARD TYPE	CIRCUIT
A4A373	-	Vacant
A374	-	Vacant
A375	-	Vacant
A376	-	Vacant
A377	DRN	MPU
A378	DRN	MPU
A379	DRN	MPU
A380	-	Vacant
A381	-	Vacant
A382	EHK	MPU
A383	DRL	MPU
A384	DRL	MPU
A385	RHF	MPU
A386	-	Vacant
A387	FQH	MPU
A388	DRL	MPU
A389	EHK	MPU
A390	AFA	MPU
A391	AFA	MPU
A392	RHF	MPU
A393	DRL	MPU
A394	DRL	MPU
A395	DRN	MPU
A396	DRN	MPU
A397	DRN	MPU
A398	DRN	MPU
A399	EHK	TIMP (RIGHT)
A400	EHK	TIMP (RIGHT)
A401	EHK	TIMP (LEFT)
A402	EHK	TIMP (LEFT)
A403	CHH	TIMP
A404	CHH	TIMP
A405	RHG	TIMP
A406	CHH	TIMP
A407	RHG	TIMP
A408	RHF	TIMP
A409	NHL	TIMP
A410	NFM	TIMP (RIGHT)
A411	NFM	TIMP
A4112	-	Vacant
A413	-	Vacant
A414	RQA	TIMP
A415	JHD	TIMP
A416	NFE	TIMP
A417	NFE	TIMP
A418	NFE	TIMP
A419	NFE	TIMP
A420	EJC	TIMP/PWMN
A421	FPB	)
A422	*	)
A423	*	) Power Supply
A424	*	)

LOCATION	CARD TYPE	CIRCUIT
A4A425	*	)
A426	*	)
A427	*	)
A428	*	)
A429	*	)
A430	*	) Power Supply
A431	*	)
A432	*	)
A433	*	)
A434	*	)
A435	*	)
A436	*	)
A437	*	)
A438	*	)
A439	*	)
A440	*	)
A441	FPB	)
A442	*	)
A443	*	)
A444	*	)
A445	*	)
A446	*	)
A447	*	)
A448	*	)
A449	*	)
A450	*	) Power Supply
A451	*	)
A452	*	)
A453	*	)
A454	*	)
A456	*	)
A457	*	)
A458	*	)
A459	*	)
A460	*	)
A461	UPW	)
A462	*	)
A463	*	)
A464	*	)
A465	*	)
A466	*	)
A467	*	)
A468	*	)
A469	*	) Power Supply
A470	*	)
A471	*	)
A472	*	)
A473	*	)
A474	*	)
A475	*	)
A476	*	)
A477	*	)
A478	*	)
A479	*	)
A480	*	)

CDC CARD LOCATIONS

LOCATION	CARD TYPE	CIRCUIT
A3A1	EJC	IDI
A2	EJC	IDI
A3	EJC	IDI
A4	EJC	IDI
A5	EJC	IDI
A6	EJC	IDI
A7	EJC	IDI
A8	EJC	PPE/IDI
A9	RHG	HMI/VMI/PRT/IDI
A10	NFM	IDI
A11	NFM	IDI
A12	NFM	IDI
A13	NFM	IDI
A14	NFM	IDI
A15	GHK	PPE
A16	NFM	IDI
A17	NFM	IDI
A18	NFM	IDI
A19	NFM	IDI
A20	AFA	IDI
A21	AFA	IDI
A22	NFM	PRT
A23	RHF	SMI
A24	CHP	SMI
A25	RQA	SMI
A26	RFL	IDI
A27	YEA	MUP1
A28	YEA	MPU1
A29	DRN	MUP1
A30	DRN	MPU1
A31	EYA	MPU1
A32	EYA	MPU1
A33	DRM	MPU1
A34	DRM	MPU1
A35	DRM	MPU1
A36	DRM	MPU1
A37	DRM	MPU1
A38	DRM	MPU1
A39	DRM	MPU1
A40	DRM	MPU1
A41	DRM	MPU1
A42	DRM	MPU1
A43	DRM	MPU1
A44	DRM	MPU1
A45	DRM	MPU1
A46	DRM	MPU1
A47	DRM	MPU1
A48	DRM	MPU1
A49	DRN	MPU1

LOCATION	CARD TYPE	CIRCUIT
A3A50	DRN	MPU1
A51	DRN	MPU1
A52		Vacant
A53	DRN	MPU2
A54	DRN	MPU2
A55	EYA	MPU2
A56	EYA	MPU2
A57	-	Vacant
A58	DRM	MPU2
A59	DRM	MPU2
A60	DRM	MPU2
A61	DRM	MPU2
A62	DRM	MPU2
A63	DRM	MPU2
A64	DRM	MPU2
A65	DRM	MPU2
A66	DRM	MPU2
A67	DRM	MPU2
A68	DRM	MPU2
A69	DRM	MPU2
A70	DRM	MPU2
A71	DRM	MPU2
A72	DRN	MPU2
A73	DRN	MPU2
A74	DRN	MPU2
A75	DRN	MPU2
A76	FEA	NS2
A77	FEA	NS2
A78	NHF	NS2
A79	NHF	NS2
A80	NHF	NS2
A81	NHF	NS2
A82	NHF	NS2
A83	NHF	NS2
A84	NHF	SZR
A85	NHF	SZR
A86	KDN	RAG/KEY
A87	KDN	RAG/KEY
A88	KDN	RAG/KEY
A89	EMB	RAG
A90	RMB	RAG/KEYU
A91	EHK	IDI
A92	EHK	HMI/VMI
A93	EHK	PRT/SMI
A94	EHK	IDI
A95	EHK	IDI
A96	ENK	IDI
A97	MDP	NS1
A98	MDP	NS1
A99	MDP	NS1
A100	MDP	NS1
A101	MDP	NS1

LOCATION	CARD TYPE	CIRCUIT
A3A102	EHK	NS1
A103	FEA	NS1
A104	FEA	NS1
A105	RHF	HMI/NS1
A106	NHF	NS1
A107	NHF	NS1
A108	NHF	NS1
A109	EHK	IDI
A110	EHK	IDI
A111	NFE	HMI/VMI
A112	NFE	SMI
A113	EHA	HMI/VMI
A114	RHG	HMI/VMI
A115	CHP	HMI/VMI
A116	RHF	HMI/VMI
A117	EHA	HMI
A118	RFL	HMI
A119	-	Vacant
A120	-	Vacant
A121	-	Vacant
A122	-	Vacant
A123	DRM	MPU1
A124	DRM	MPU1
A125	-	Vacant
A126	DRL	MPU1
A127	DRL	MPU1
A128	RHF	MPU1
A129	DRJ	MPU1/MON
A130	DRH	MPU1
A131	DRL	MPU1
A132	EHK	MPU1
A133	AFA	MPU1
A134	AFA	MPU1
A135	RHF	MPU1
A136	DRL	MPU1
A137	DRL	MPU1
A138	DRN	MPU1
A139	DRN	MPU1
A140	DRN	MPU1
A141	DRN	MPU1
A142	-	Vacant
A143	-	Vacant
A144	-	Vacant
A145	-	Vacant
A146	DRN	MPU2
A147	-	Vacant
A148	-	Vacant
A149	-	Vacant
A150	DRL	MPU2
A151	DRL	MPU2
A152	RHF	MPU2
A153	DRJ	MON/MPU2

LOCATION	CARD TYPE	CIRCUIT
A3A154	DRH	MPU2
A155	DRL	MPU2
A156	EHK	MPU2
A157	AFA	MPU2
A158	AFA	MPU2
A159	RHF	MPU2
A160	DRL	MPU2
A161	DRL	MPU2
A162	DRN	MPU2
A163	DRN	MPU2
A164	DRN	MPU2
A165	DRN	MPU2
A166	FEA	SDCV/KEY
A167	RHF	NS2
A168	EHK	NS2
A169	EJC	TM
A170	KDM	RAG/KEY
A171	RRF	MAMO
A172	*	
A173	RRF	MAMO
A174	*	
A175	MDP	ATT/DIGS
A176	MDP	NS2
A177	MDP	NS2
A178	MDP	NS2
A179	MDP	NS2
A180	MDP	NS2
A181	EJC	MP
A182	NFE	MP
A183	NFE	MP
A184	NFE	MP
A185	NFE	MP
A186	NFE	MP
A187	EHK	MP
A188	EHK	MP
A189	EHK	MP
A190	EHK	MP
A191	EHK	MP
A192	EHK	MP
A193	EHK	MP
A194	RFL	IDI
A195	CHP	MP
A196	RHF	MP
A197	RHF	MP
A198	CHH	MP
A199	RHF	MP
A200	RFL	IDI
A201	RHG	MP
A202	RHF	MP
A203	RHG	MP
A204	GHK	MP
A205	RQA	MP

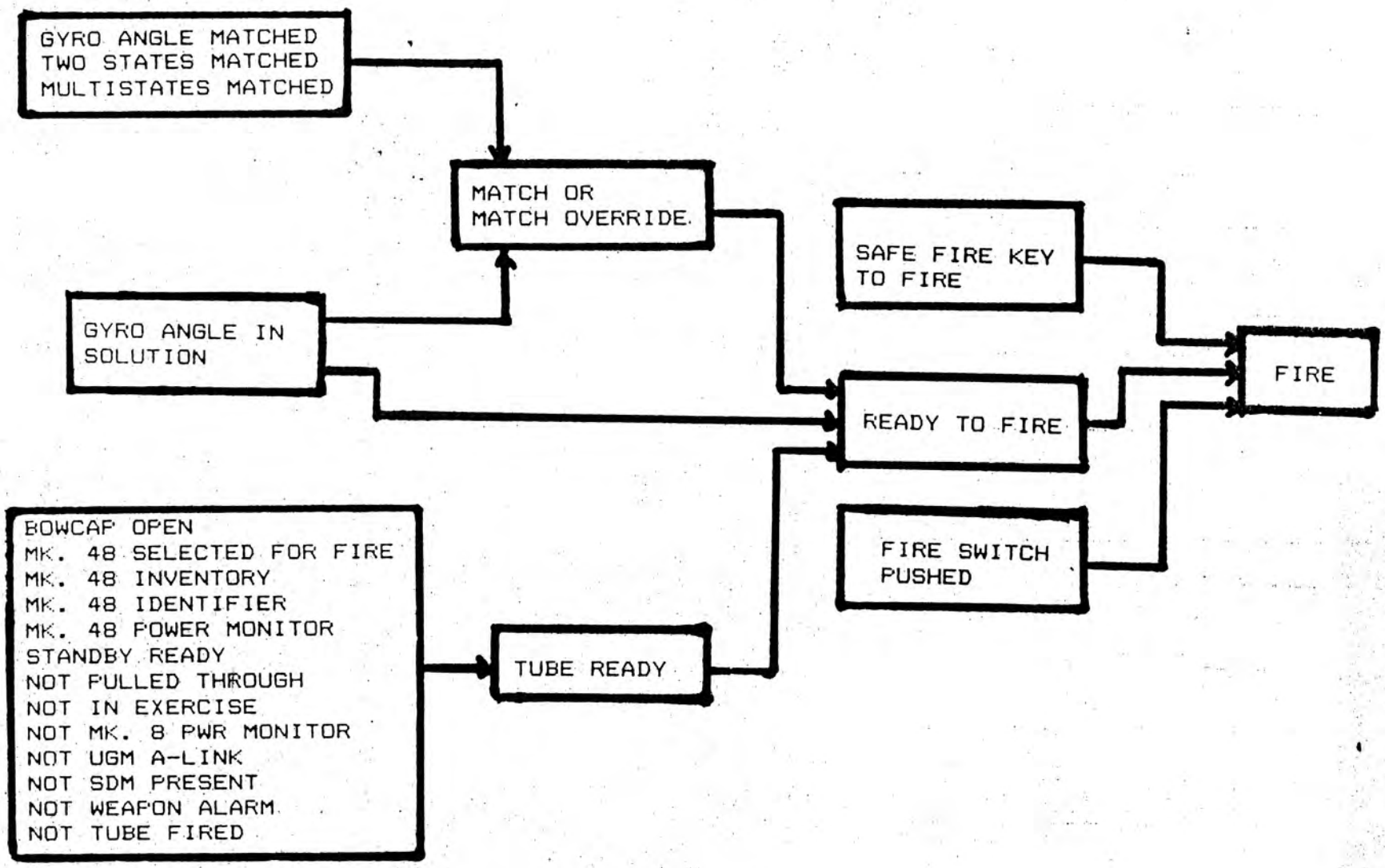
LOCATION	CARD TYPE	CIRCUIT
A3A206	RQA	MP
A207	-	Vacant
A208	-	Vacant
A209	JHD	MP
A210	JHD	MP
A211	JHD	MP
A212	JHD	MP
A213	JHD	MP
A214	JHD	MP
A215	JHD	MP
A216	JHD	MP
A217	JHD	MP
A218	BHL	MP
A219	BHL	MP
A220	RHG	CLK
A221	-	Vacant
A222	FEA	CLK
A223	FEA	CLK
A224	FEA	CLK
A225	FEA	CLK
A226	FVC	CLK
A227	CHP	SDCV
A228	CHP	MAMO
A229	RHF	MAMO
A230	NFE	MAMO
A231	NFE	MAMO
A232	AFA	SDCV
A233	SHU	SDCV
A234	SHY	SDCV
A235	KMA	SDCV
A236	*	
A237	*	
A238	RHF	SDCV
A239	KMC	SDC
A240	*	
A241	KMB	SDCV
A242	*	
A243	KMB	SDCV
A244	*	
A245	KMB	SDCV
A246	*	
A247	KMB	SDCV
A248	*	
A249	KMB	SDCV
A250	*	
A251	KMB	SDCV
A252	*	
A253	KMB	SDCV
A254	*	
A255	KMB	SDCV
A256	*	
A257	KMB	SDCV

LOCATION	CARD TYPE	CIRCUIT
A3A258	*	
A259	KMB	SDCV
A260	*	
A261	KMB	SDCV
A262	*	
A263	KMB	SDCV
A264	*	
A265	KMB	SDCV
A266	*	
A267	KMB	SDCV
A268	*	
A269	KMB	SDCV
A270	*	
A271	FPM	)
A272	*	)
A273	*	)
A274	*	)
A275	*	)
A276	*	)
A277	*	) Power Supply
A278	*	)
A279	*	)
A280	*	)
A281	*	)
A282	*	)
A283	*	)
A284	*	)
A285	*	)
A286	TP	)
A287	*	)
A288	*	)
A289	*	)
A290	*	)
A291	*	) Test Panel
A292	*	)
A293	*	)
A294	*	)
A295	*	)
A296	*	)
A297	*	)
A298	FPN	
A299	*	
A300	FFG	MON/CLK
A301	FFG	MON
A302	FFG	MON
A303	FFG	MON
A304	FFG	DIM
A305	FEA	DIM
A306	RHG	MON
A307	EJC	MON/IDI
A308	CHP	MON

LOCATION	CARD TYPE	CIRCUIT
A3A309	RHF	MON
A310	TSS	MON
A311	FMF	ON
A312	AFA	IDI
A313	EHK	IDI
A314	-	Vacant
A315	-	Vacant
A316	DRM	MPU3
A317	DRM	MPU3
A318	DRM	MPU3
A319	DRM	MPU3
A320	DRM	MPU3
A321	DRM	MPU3
A322	EYA	MPU3
A323	DRL	MPU3
A324	DRJ	MPU3
A325	DRH	MPU3
A326	DRM	MPU3
A327	DRL	MPU3
A328	EHK	MPU3
A329	AFA	MPU3
A330	AFA	MPU3
A331	RHG	MTI
A332	DRL	MPU3
A333	DRN	MPU3
A334	-	Vacant
A335	DRN	MPU3
A336	DRN	MPU2
A337	DRN	MPU3
A338	DRN	MPU3
A339	DRN	MPU3
A341	-	Vacant
A342	RHF	MTI
A343	GHK	MTI
A344	FEA	MTI
A345	EHK	MTI
A346	RHF	NS3
A347	FEA	NS3
A348	FEA	NS3
A349	EHK	NS3
A350	MDP	NS3
A351	MDP	NS3
A352	MDP	NS3
A353	MDP	NS3
A354	MDP	NS3
A355	NHF	NS3
A356	NHF	NS3
A357	NHF	NS3
A358	NFE	MTI
A359	NFE	PTI
A360	NFE	MTI

BLANK

LOCATION	CARD TYPE	CIRCUIT
A3A413	UPW	) Power Supply
A414	*	)
A415	*	)
A416	*	)
A417	*	)
A418	*	)
A419	*	)
A420	*	)
A421	*	)
A422	*	)
A423	*	)
A424	*	) Power Supply
A425	*	)
A426	*	)
A427	*	)
A428	*	)
A429	*	)
A430	*	)
A431	UPW	)
A432	*	)
A433	*	)
A434	*	)
A435	*	)
A436	*	)
A437	*	)
A438	*	) Power Supply
A439	*	)
A440	*	)
A441	*	)
A442	*	)
A443	*	)
A444	*	)
A445	*	)
A446	*	)
A447	*	)
A448	*	)
A449	*	)
A450	*	)



WEAPON FIRING INTERLOCK FLOW DIAGRAM

SECONDARY MODE OPERATION

THE SECONDARY MODE IS USED WHEN A FAILURE OF THE CPU, MMU, OR SDC HAS OCCURRED. PROGRAM PROCESSING, IN THE SECONDARY MODE, IS UNDER CONTROL OF FCC FIRMWARE INSTEAD OF COMPUTER PROGRAMME. ALL FUNCTIONS REQUIRED FOR WEAPON AND TUBE CONTROL, INCLUDING WEAPON PRESETTING, FIRING AND GUIDANCE ARE PROVIDED FOR ONE TORPEDO AT A TIME AND UP TO FOUR MISSILES AT A TIME, BY ONE FCC COMMUNICATING DIRECTLY WITH THE WDC.

SECONARY MODE IS RESTRICTED TO A SINGLE CONSOLE. CONSEQUENTLY, ONLY A SINGLE TARGET CAN BE CHOSEN, A SINGLE WEAPON TYPE OR WATERSHOT ASSIGNED, AND TUBES ALLOCATED TO MEET THE FOLLOWING CRITERIA:

1) UP TO FOUR UGM 84 (THREE IF IN THE LIMITED POWER MODE).

2) ONE MARK 48.

3) UP TO SIX WATERSHOTS.

4) TUHE UGM 84 CAN ONLY BE PRESET IN BOL AND SELF LEVELING MODES.

ENTRY INTO SECONDARY MODE

THE SECONDARY MODE IS ENTERED AS A RESULT OF SETTING EITHER, BUT ONLY ONE FCC MODE SELECT SWITCH TO SECONDARY.

1) COMMUNICATION BETWEEN THE TWFCSI OF THE FCC SET TO SECONDARY AND THE CPU IS INHIBITED, THE SECONDARY INITIALISATION TOTE IS DISPLAYED ON THAT CONSOLE, AND DIRECT COMMUNICATIONS BETWEEN THAT CONSOLE AND THE WDC IS ESTABLISHED.

2) THE CRT OF THE CONSOLE SET TO SECONDARY IS AVAILABLE FOR THE NORMAL FUNCTION OF A TACTICAL FCC, ie, ALL PAGES EXCEPT WCD, SID, AND TRNG.

3) THE REMAINING EQUIPMENT IN THE CONTROL ROOM CAN OPERATE IN ANY OF THE OTHER SYSTEM MODES: TACT, TRNG, OR TEST.

4) THE ENABLING OF SECONDARY MODE IS COMPLETE WHEN THE SAFE/FIRE KEY IS SET TO FIRE AND THEN BACK TO SAFE.

5) THE SECONDARY INITIALISATION TOTE IS DISPLAYED ON THE LEFT HALF OF THE TOTE DISPLAY PANEL. THE TOTE PROVIDES THE CAPABILITY OF DESIGNATING THE WEAPON TYPE AS WARSHOT OR EXERCISE QAND THE ENTRY OF CURRENT TIME. IT ALSO PROVIDES INSTRUCTIONS TO ENABLE THE SECONDARY MODE ANFD A READOUT OF MICROPROCESSOR ERRORS.

6) ON COMPLETION OF INITIALISATION, CYCLE THE TOTE TO THE THREAT TOTE AND ENTER OWN SHIP AND TARGET PARAMETERS. (UP TO FOUR THREATS) AUTOMATIC POSITION KEEPING IS INITIATED WHEN OWN SHIPS DATA HAS BEEN ENTERED.

A MORE IN DEPTH DESCRIPTION OF THE SECONDARY MODE OF OPERATION IS CONTAINED IN ABR 5297, CHAP.3, SECT.2, PAGE 350.

CASUALTY MODE OPERATION

THE CASUALTY MODE IS USED WHEN THE WDC CANNOT PROPERLY COMMUNICATE WITH THE HARPOON MISSILES IN THE TUBE. THE TOAD PROVIDES CONTROLS AND INDICATORS TO ALLOW SELECTION, POWER UP, AND FIRING OF ONE MISSILE AT ONE TIME IN A BEARINGS ONLY LAUNCH EMPLOYING SELF LEVELLING.

CASUALTY MODE OPERATING PROCEDURE

1) ATTACH THE SPECIAL B-LINK CABLE BETWEEN THE TOAD CONNECTOR J8 AND THE C-UNIT ON THE DESIGNATED TUBE.
2) AT THE TOAD FRONT PANEL, SET THE 115V 400HZ AND 24VSS CIRCUIT BREAKERS TO ON AND ENSURE INDICATORS ARE LIT.
3) OPEN THE LOCKED COVER ON THE FRONT OF THE TOAD.
4) SET THE 205V 400HZ AND THE +/-28VDC CIRCUIT BREAKERS TO ON.
5) SET THE STEER SWITCH TO THE LEFT OR RIGHT.
6) PRESS THE SELECT OP PWR SWITCH INDICATOR, ENSURE INDICATOR IS ON. (SEE NOTE A.)
7) PRESS THE READY/ITL SWITCH INDICATOR, THE INDICATOR SHOULD LIGHT AND THE ITL SIGNAL IS SENT TO THE MISSILE. AT 2.5 SECONDS AFTER THE SWITCH IS PRESSED, THE PULL THRU ENABLED INDICATOR COMES ON IF THE MISSILE ENABLED SIGNAL HAS BEEN RECIEVED FROM THE MISSILE.
8) PERFORM THE PULL THRU PROCEDURE FOR THE DESIGNATED TUBE TO DISCHARGE THE MISSILE. (SEE NOTE B)

NOTE A

PUSHING SELECT INITIATES THE FOLLOWING SEQUENTIAL ACTIONS:

a) THE UGM A-LINK MONITOR SIGNAL IS TRANSMITTED TO THE TUBE.
b) A POSITIVE RESPONSE FROM THAT TUBE RESULTS IN THE IDENT/STATUS POWER SIGNAL BEING TRANSMITTED TO THE MISSILE.
c) 30 SECONDS AFTER THE IDENT/STATUS POWER SIGNAL HAS BEEN TRANSMITTED, THE TOAD MONITORS THE MISSILE PRESENT AND CAPSULE STATUS SIGNAL LINES FROM THE MISSILE.
d) RECEPTION OF THESE SIGNALS CAUSES THE IMMEDIATE TRANSMISSION OF THE DC MONITOR/RESET POWER SIGNAL TO THE MISSILE.
e) RECEPTION, THEN, OF A "TRUE" BOOSTER SAFE SIGNAL AND A "FALSE" BOOSTER ARMED SIGNAL CONNECTS OPERATE POWER TO THE MISSILE AND TURNS ON THE OP PWR LAMP.
f) 30 SECONDS AFTER OPERATE POWER IS CONNECTED, THE READY INDICATOR COMES ON TO INDICATE THAT THE MISSILE IS READY TO FIRE.

NOTE B

IN THE EVENT OF A MALFUNCTION, INDICATED BY THE ABSENCE OF LIGHTED INDICATORS IN THE PROPER FIRING SEQUENCE AND THE TIME PERIODS SPECIFIED, THE FOLLOWING CANCELLATION/SHUTDOWN PROCEDURES ARE TO BE PERFORMED:

a) IF, AFTER PRESSING THE SELECT/OP PWR SWITCH INDICATOR, THE OP PWR LAMP DOES NOT COME ON (AFTER APPROX 30 SECS), PRESS THE SELECT/OP PWR SWITCH INDICATOR A SECOND TIME TO REMOVE DCMONITOR/RESET POWER AND IDENT/STATUS POWER SIGNALS, IN THAT ORDER, FROM THE MISSILE.
b) IF, AFTER PUSHING THE READY/ITL SWITCH INDICATOR, THE PULL THRU ENABLED LAMP DOES NOT COME ON (AFTER APPROX 2.5 SECS), PRESS THE SHUTDOWN SWITCH INDICATOR TO ORDER CAPSULE SAFE OF THE MISSILE AND THEN PRESS THE SELECT/OP PWR SWITCH INDICATOR TO REMOVE ALL POWER TO THE MISSILE.

WEAPON TESTING

Section 1

INTRODUCTION

Aim

1. To prove correct pre-launch data transmission from MK48 warshot and pratice weapons.

2. To prove correct pre-launch data transmission from UGM84 warshots, UGM84 practice rounds and EHCTV's.

Pre-requisites

3. A fully serviceable combat system.

Safety Precautions

4. Under no circumstances will transmission checks be conducted on MK48, UGM84 and EHCTV weapons outside of a shut torpedo tube.

5. If indications of a flooded 'A' cable are observed, secure weapon supply power and tube select immediately.

6. If indications of 'Weapon Alarm' are observed testing is to cease until cause is located.

NOTE: Power on times for 48, 84 (30 minutes) must not be exceeded.

References

7. AFTP 23 (Submarine Firing and certification manual)
ABR 5297 (SFCS MARK 1 MOD 1)
ABR 5486 (WHOPS)-OP31 (MK48) OP33 (UGM-84)
OP17 WEAPON LOADING

Facilities

8. Equipment

a. MK48, MK48P, UGM84, UGM84TM or EHCTV as appropriate.

b. MK22 simulator

c. SDM

d. Portable CT units.

e. 48-1 and 84-1 test cables.

f. DLS operational.

9. Personnel

a. Torpedo Officer.

b. POUW

c. SFCS maintainer.

Duration

10. As required.

Procedures

11. As per Section Two.

Records

12. Weapon Log

13. DLS tape to RANTAU if any tests are unsuccessful.

Section 2

(MK48 torpedoes)

Pre-requisite: SFCS OFF-LINE (EMBARKATION TEST)

1. Off-line testing complete and correct for WDC loop, 48 internal and 48 loop-back for all firing tubes (DT1-DT5).

2. DLS off line tests correct (Status, Read/Write).

(On first loading of weapons):

Procedure

1. Ensure AC & DC power breakers on WDC are OFF before loading weapon in tube.

2. Load torpedo MK48 into tube in accordance with OP17.

3. Verify and record torpedo configuration.

4. Verify that designated torpedo tube is completely secured.

5. Make AC and DC power breakers on WDC for nominated tube(s).

6. With SFCS in OFF LINE TEST mode select Weapon Test for tubes to be tested.

7. Conduct Weapon Test.

8. On successful completion on test, de-select.

9. Ensure WDC AC and DC power breakers are off.

10. Withdraw and stow weapon.

Pre-requisite: SFCS - ON LINE (OPERATIONAL TEST)

1. Off-line testing complete and correct for WDC loop, 48 internal, 48 loop-back for all firing tubes (DT1-DT5).

2. DLS off-line tests correct (Status & Read Write). Heads cleaned.

3. SFCS on line.

4. DLS on-line tape loaded. DLS to be running in trials mode when conducting weapon checks. Tape may be rewound and re-used if weapon correct. If weapon fails, DLS tape to be returned to RANTAU for analysis.

Procedure

1. Ensure AC and DC power breakers on WDC to OFF before loading.

2. Load a torpedo MK48 into tube in accordance with OP17.

3. Verify and record torpedo configuration.

4. Verify that designated torpedo tube is completely secured.

5. Make AC and DC power breakers on WDC for nominated tube.

6. Select correct weapon type on TOAD selection switches.

7. Enter a THREAT on SFCS that is within weapon limits (use CDC keyboard periscope set up for ease of entry.)

   a. CHOOSE a target.

   b. ASSIGN a MK48.

   c. ALLOCATE tube to be tested.

8. SELECT tube to be tested.

9. Confirm MATCH indicator lit.

10. Alter all two state and multi-state presets one at a time, confirming that MATCH lights after each alteration.

11. On WCD page select GA by light pen. Alter GA to achieve both left and right gyro angles. Confirm MATCH lit. Alter GA to greater than 165 left or right. Confirm MATCH existinguished and warning GA OUT OF SOLUTION shows on screen. Set GA to 000 before deselecting.

12. Press EX-BIT. Note EX lit (this tests the tone commands via guidance wire).

13. Confirm MATCH lit.

14. Alter all Post Launch two state/multi state presets one at a time. Observing TIP lamp lights as signal passed on wire. Confirm MATCH lights after each alteration.

15. Select MAN.

16. Send steer commands. Observe TIP. (Note MATCH will be lost due to misalignment, not a defect.) Return GA to 0°.

17. Press EX-BIT, confirm EX lamp extinguished and presets revert to selected tactic on WCP page.

18. DESELECT TUBE

Notes:

1. Failure to obtain MATCH; press SET/READBACK to ascertain which pre-set is not algined. Attempt to alter that preset to obtain MATCH.

2. If MATCH still not obtained check WDC breakers, TOAD switches, guidance wire, 'B' link 'A' cable.

3. Test another weapon in the same tube to prove tube circuits before rejecting weapon.

Section Three

(UGM84 EHCTV)

Pre-requisite

1. Off line testing complete and correct for WDC loop, 84 internal 84 loop back.

2. DLS off-line tests correct (Status, Read-Write). Heads cleaned.

3. SFCS on-line.

4. a. DLS on-line, tape loaded.

   b. DLS to be running in trials mode when conducting weapon checks. Tape may be rewound and re-used if weapon correct.

   c. If weapon fails, DLS tape to be returned to RANTAU for analysis.

Procedure

5. Load UGM/CTV into tube in accordance with OP18.

6. Verify and record capsule configuration.

7. Verify that designated torpedo tube is completely secure.

8. Make AC-DC power breakers on WDC.
   Set TOAD switch to UGM84.
   Set heater on TOAD to ENABLE.

9. a. Enter a THREAT on SFCS (within weapon limits).

   b. Choose TARGET.

   c. Assign UGM.

   d. Allocate tube to be tested.

10. Select tube. Note time UGM is selected (total 30 mins for UGM84 TM).

11. Confirm MATCH.
    There will be a delay as weapon responds of approx 30 secs.
    UGM COMMS FAILED XX will show on ARO of page, this is not a fault and will disappear when MATCH is obtained.

12. Conduct BIT by pressing EX-BIT switch on TWFCSI. Test takes approx 20 sec during which time MATCH will extinguish. At successful completion of BIT, EX-BIT lamp will extinguish and MATCH illuminate. If BIT is unsuccessful FAILED lamp will illuminate on EX-BIT switch/indicator on TWFCSI. (Tube must be de-selected/reselect to clear FAILED LIGHT.

13. After conducting BIT cycle through the Search Pattern Options on WCD page. Ensure MATCH remains for all patterns.

14. If weapon will not match or pass BIT test in another tube, change 'A' link. If still unsuccessful reject weapon.

Note:

1. Test tube/SFCS with SDM to ensure correct operation of system.

2. When flooding tubes for firing SELECT tube being flooded, observe MATCH, any loss of MATCH will indicate possible water ingress.

3. Note total time power is applied for UGM - record in weapon log.

Alarms

15. There are a number of alarm conditions associated with HARPOON/EHCTV testing and firing. They are summarised as follows:

a. CD Flood. This alarm signifies moisture in the CD unit on the inside of the tube door. To rectify this problem the tube will have to be drained down and the rear door opened to gain access to the plug. Any moisture found should be removed and a new 'O' seal installed, great care has to be exercised in installing this plug to prevent leaks.

b. Weapon Alarm. This alarm is a firing interlock and can be caused by a variety of reasons namely:

(1) 'A' link not present or open circuit;

(2) 'A' link monitor not correct;

(3) Inventory not a UGM84 on TOAD;

(4) leak detectors in CTV active ie, wet;

(5) booster armed;

(6) booster not safe;

(7) Missile Enabled;

(8) ITL not latched.

16. Most likely causes of WEAPON ALARM in EHCTV firings are switches not correct or open circuit in the A cable. Any open circuit or moisture in the Hockey Puck end of the A cable will result in a WEAPON ALARM. To rectify these problems the CTV will have to be partially withdrawn and the A cable replaced, thorough inspection of the capsule connector should also be made to ascertain damage.

MARK 22 MOD 1 WEAPON SIMULATOR

OPERATING INSTRUCTIONS

1. Connecting up procedure.

The Mark 22 weapon simulator requires 115 Volt 400 Hertz 3 Phase and 24 Volt DC external supplies. These supplies are feed to the weapon simulator, via socket P2, from two sockets mounted on the starboard side of the fore-ends, just aft of the Mark 1 weapon simulator. The other supplies are feed via an "A" link from the SFCS. The "A" link is connected to the weapon simulator, from a tube "B" link, via a portable "CD" unit or through the rear door. A guidance wire must be connected between the "A" and "B" links.

2. Initialization.

a. Check external 115V 400 Hz 3Ø and 24 VDC sockets are switched OFF.

b. Check the circuit breakers, on the bottom left hand side of the weapon simulator, for: - 26 VDC, + 30 VDC, - 30 VDC and 115 VAC, are OFF.

c. Check that the 'monitor circuit' switch is to the NORMAL position.

d. Check that the 'continuity' potentiometer is rotated 1/3 clockwise.

e. Check that the 'continuity' switch is to the CONTINUITY OR REATTACK position.

f. Check that all multistate and two state switches are to NORMAL.

g. Check that the TDS is reset.

h. Check that the WDC contractor panel is set up as follows:

	ACPS	DCPS	GS/PP	PRE FIRE	MS	FS
WG-Y	ON	ON	ON	OFF	ON	ON

3. Initial Turn On.

a. Switch the external supplies to ON.

b. Make the weapon simulator circuit breakers for -26 VDC, +30 VDC, - 30 VDC and 115 VAC.

c. Check that the green light above the 115 VAC circuit breaker illuminates.

d. Check that the 'phase rotation' lamp illuminates.

e. Check that the 'voltage monitor' meter is illuminated.

f. Check thaty the 'shutdown' and 'X10' indicators are illuminated. Press each reset switch and check that each indicator is extinguished.

g. Check that only one indicator for each two state and multistate is illuminated.

h. Check that either the 'ceiling or op depth' indicator is illuminated.

4. On selecting W/G-Y.

a. Check that the greeen lights above the -26 VDC, +30 VDC and - 30 VDC circuit breakers are illuminated.

b. Press the 'reset' switch up until all chattering stops.

c. Check that the continuity current on the 'voltage monitor' meter is 1.5 mA.

d. Check for a 'match' on the TWFCSI. If not refer to paragraph 7.

e. Check for a 'ready' on the TWFCSI, when the submarine speed and depth are within limits, and the following indicators are illuminated on the TWFCSI and TOAD:

(1) Patrol Ready

(2) Action Ready

(3) Standby Ready

(4) Bowcap Open

(5) Tube Selected.

5. On Firing.

a. When the firing solenoid lifts, trips the TDS.

b. Check that the +30 VDC and - 30 VDC indicators are extinguished.

c. Check that the 'fire', 'impulse' and 'motor start' indicators are illuminated.

d. Check for 'continuity' on the voltage monitor meter.

6. After Firing.

If acquisition is required, place the 'monitor' switch to ACQUIRED. If a broken wire is to be simulated, place the 'monitor' switch to OFF. The X10 will come on every time the X10 button is pressed on the TWFCSI. It has no effect on the weapon simulator other than to illuminate the X10 indicator, and it must be manually reset each time.

7. Maintenance Checks.

a. If the 'match' indicator is extinguished on the TWFCSI:

(1) Deselect the tube, then reselect the tube, reset the weapon simulator.

(2) Check all two-state and multi-state switches are to NORMAL. If the switch is to HOLD or OVERRIDE switch to NORMAL and reset the weapon simulator.

(3) If a two-state or multi-state is incorrect in the NORMAL switch position, put the switch to OVERRIDE and rotate the 'override control' knob until the required state is achieved. Place the switch back to the NORMAL position and check for a 'match' on the TWFCSI.

(4) Check that the TOAD inventory switch is to W/G-Y.

b. If the 'ready' indicator is extinguished on the TWFCSI, check that the monitor switch is to MONITOR.

c. If no wire or guidance, check that the continuity current is 1.5 mA and that the guidance wire is connected.

STATIC POWER INVERTER OPERATING PROCEDURE

THE STATIC POWER INVERTER MUST BE RUNNING TO ALLOW SUFFICIENT POWER TO FIRE A FULL SALVO OF SIX HARPOON MISSILES.

TURN ON

1) SET CIRCUIT BREAKER A1A6CB1 TO ON POSITION. POWER OUTPUT INDICATOR LIGHTS AFTER 4 SECONDS.

CAUTION

THE OUTPUT VOLTAGE ADJUSTMENT MUST BE VARIED IN THE FOLLOWING SEQUENCE DUE TO INTERACTION OF PHASE AB AND PHASE BC.
INCREASE CA, AB, BC. DECREASE AB, BC, CA.

2) SET VOLTAGE SELECTOR SWITCH A1A6S1 TO CA. VOLTMETER SHOULD SHOW 114-126VAC.

3) OBSERVE VOLTMETER AND ADJUST POTENTIOMETER R785 UNTIL METER INDICATES ANY DESIRED VOLTAGE BETWEEN 114 AND 126VAC.

4) SET VOLTAGE SELECTOR SWITCH A1A6S1 TO AB. VOLTMETER SHOULD SHOW 114-126VAC.

5) OBSERVE VOLTMETER AND ADJUST POTENTIOMETER R787 UNTIL METER INDICATES ANY DESIRED VOLTAGE BETWEEN 114 AND 126VAC.

6) SET VOLTAGE SELECTOR SWITCH A1A6S1 TO BC. VOLTMETER SHOULD SHOW 114-126VAC.

7) OBSERVE VOLTMETER AND ADJUST POTENTIOMETER R786 UNTIL METER INDICATES ANY DESIRED VOLTAGE BETWEEN 114 AND 126VAC.

8) THE INVERTER IS NOW IN NORMAL OPERATING MODE.

TURN OFF

1) REMOVE LOAD FROM INVERTER.

2) CIRCUIT BREAKER A1A6CB1 TO OFF.

3) POWER OUTPUT INDICATOR LAMP GOES OUT.

CAUTION

DO NOT OPERATE THE INVERTER IN A NO-LOAD CONDITION IN EXCESS OF ONE HOUR.

FURTHER INFORMATION ON ADJUSTMENTS, REFER TO NAVSEA S9314-AQ-MMO-010/4345E PAGE 6.1 (1600HZ FREQUENCY ADJUSTMENT).

DATA LOGGING SYSTEM OPERATION

PRE OPERATION CHECKS

AT CONTROL BOX:

1) SWITCH ALL TO HIGH DENSITY.

2) UNIT SELECTED = 0.

3) UNIT MODE = THUMBWHEELS SET TO 0,1.2,3.

4) CLEAN HEADS WITH COTTON BUD AND ALCOHOL.

5) POWER SWITCH TO ON.

TO LOAD TAPE:

1) ENSURE THE WRITE RING ON THE BACK OF THE TAPE IS IN.

2) LOAD THE TAPE FOLLOWING THE DIAGRAM ON THE RECORDER.

3) ENSURE CONTROL BOX, RECORDER AND FIRE CONTROL POWER IS SWITCHED ON.

4) PUSH LOAD, TAPE WILL WIND ON TO A LOAD POINT AND STOP.

5) PUSH ON LINE, SMALL JUMPS WILL INDICATE TAPING DATA.

6) ON LINE, LOAD, WRITE STATUS, AND WRITE ENABLE INDICATOR LIGHTS SHOULD BE LIT DURING TAPING.

TO STOP TAPE:

1) WHEN RECORDING IS FINISHED IT IS NECCESSARY TO PUT A FILE MARKER ON THE TAPE.

   a) PRESS OFF LINE.
   b) WAIT APPROX SIX SECONDS.
   c) PRESS ON LINE, TAPE WILL MOVE TO WRITE FILE MARKER.
   d) PRESS OFF LINE.

TO REWIND TAPE:

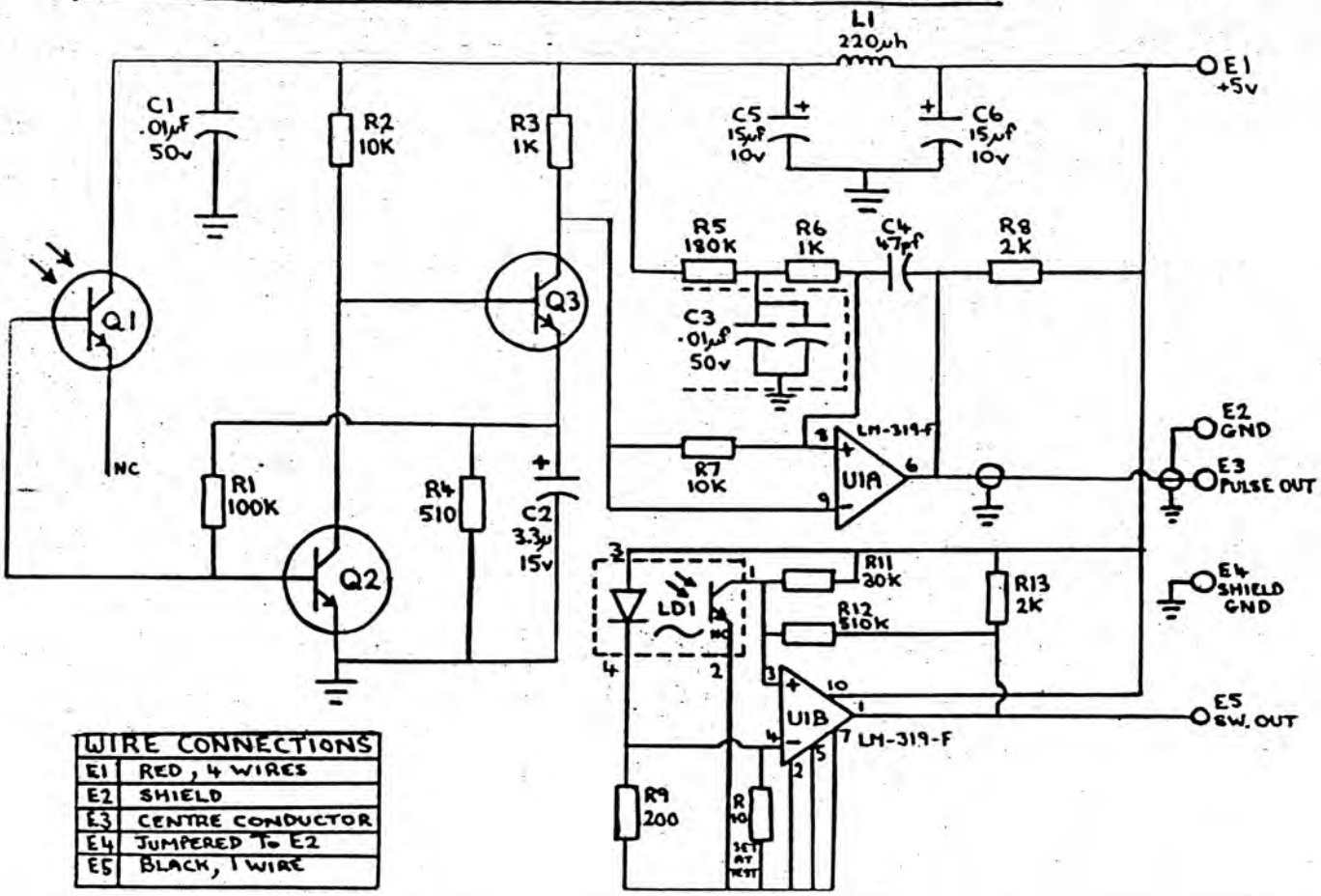
1) PRESS OFF LINE.

2) PRESS REWIND, TAPE WILL REWIND TO THE BEGINNING OF TAPE.

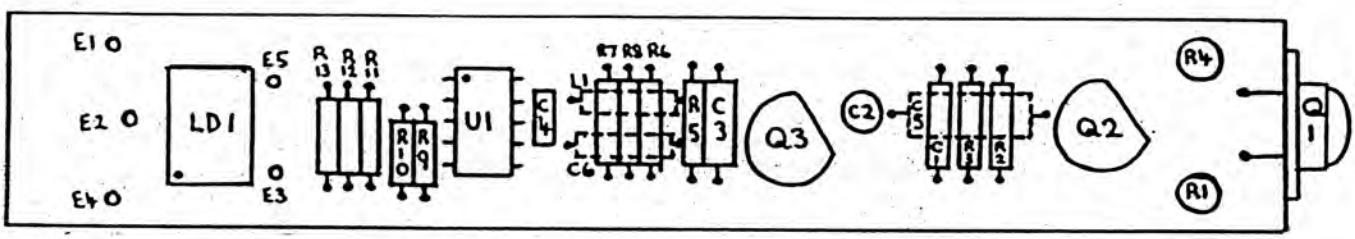
3) PRESS REWIND AGAIN, TAPE WILL WIND OFF.

NOTE : a) TAPE WILL LAST APPROX. 40 MINUTES.

b) DLS MUST BE RUN FOR ALL WEAPONS FIRINGS AND DURING ALL WEAPONS TESTING. IF A DEFECTIVE WEAPON IS FOUND DURING TESTING, DLS TAPE MUST BE SENT TO RANTAU FOR ANALYSIS.



WIRE CONNECTIONS	
E1	RED, 4 WIRES
E2	SHIELD
E3	CENTRE CONDUCTOR
E4	JUMPERED TO E2
E5	BLACK, 1 WIRE



Electrical Checkout

a. Unscrew fastening screw holding together halves of PHOTOPEN unit cable assembly connector to gain access to wiring connections inside connector.

b. With PHOTOPEN unit plugged into normal operating location (PHOTOPEN - IN jack at left end of PHOTOPEN intensifier/driver panel assembly mounted at bottom rear of display indicator cabinet), connect oscilloscope test probe to red-wire connector (+5V input). Confirm that oscilloscope indication shows presence of +5V power source.

c. Transfer oscilloscope test probe connection to black-wire conductor (SWITCH OUT). Confirm that oscilloscope indication is between +3V and +5V with PHOTOPEN unit in its normal, relaxed state.

d. Close PHOTOPEN unit housing shells together, sliding outer shell forward over inner shell. Confirm that oscilloscope indication for black-wire conductor falls to low logic value between zero volts and +0.5V while solid-state switch inside unit is activated by this mechanical displacement.

e. Transfer oscilloscope test probe to white-wire conductor (PULSE OUT). Confirm that oscilloscope indication is within +3V and +5V, with PHOTOPEN unit pointed away from display screen and held at least five feet away from fluorescent light or other equivalent light source.

f. Touch PHOTOPEN unit nose cone to active display screen so as to point unit directly at any clearly defined active display location (test pattern line, etc.). Confirm that oscilloscope indication for white-wire conductor shows recurrent low-

PULSE CIRCUIT

The PHOTOPEN pulse circuit consists of photosensitive transistor Q1, pulse amplifiers Q2 and Q3, output amplifier U1A, two low-frequency feedback filters (primary filter C2, R1, R4 and secondary filter C3, C4, R5, R6), and other associated resistors and capacitors. The input to this circuit is the light beam emitted by the CRT screen when the electron gun is presenting an active display in the area at which the PHOTOPEN unit is pointing. The output from this circuit is a low-level logic pulse of approximately one-microsecond duration. The pulse is triggered when the light beam first strikes the PHOTOPEN unit and is repeated at CRT refresh-rate intervals while the PHOTOPEN unit is held pointed at the same target area unless the program terminates the display in that area.

When the PHOTOPEN unit is pointed at the CRT display screen, the lens tube in the nose cone focuses the received light onto photosensitive transistor Q1. Transistor Q1 is connected so that its collector-base current path functions as a light-sensitive diode with reverse leakage current flow directly proportional to input light intensity. This path, activated by the received light, turns on amplifier Q2, which then turns off normally-on amplifier Q3 to activate a 100-mV signal input to output amplifier U1A. This condition drives the U1A output low. Within a period of approximately one microsecond, ac coupling capacitor C2 in the Q2/Q3 switching circuit becomes sufficiently charged to turn off amplifier Q2, thereby turning amplifier Q3 back on. These conditions remain in effect through a period of approximately ten microseconds, at which time capacitor C2 will have discharged sufficiently to let amplifier Q2 turn on again in response to the next light-beam strike. This sequence thus repeats continuously at CRT-refresh or unblanking intervals for as long as the PHOTOPEN unit is pointed at a light source of sufficiently changing intensity--hence as long as it stays pointed at a display screen area in the path of the active CRT light beam.

Any potential false-alarm pulses that might be caused by a 60-cycle light source or by general circuit noise are bypassed by an input "T" filter, consisting of C2, R1, and R4, and an output "pi" filter, consisting of C3, C4, R5, and R6. The primary, input-stage filter passes high-frequency input variations but modifies Q2 biasing to minimize response to low-frequency signals by developing a voltage drop across R4, which is invisible to high frequencies. Any low frequency signals which do get past this input stage subsequently become absorbed by the secondary output-stage filter, which is incorporated into the output amplifier feedback circuit. This pi-circuit filter absorbs low-frequency changes in the amplifier U1A output and compensates accordingly to effectively blank out circuit response to such signals.

SWITCH CIRCUIT

The independent solid-state switch circuit consists of light emitter/sensor subassembly LD1 and output amplifier U1B, together with associated biasing resistors Light emitter/sensor subassembly LD1 contains a light-emitting diode and a photosensitive transistor, with an internal baffle between them. Both of these components have access to an aperture in the inner shell of the PHOTOPEN housing assembly. When the outer shell of the PHOTOPEN unit is in its normal spring-forced rearward position, an absorbant black coating on the inside of that shell covers the aperture absorbing all light emitted by the diode. Under these conditions, the photosensitive transistor remains inactive, and the output from amplifier U1B is an inactive high logic level.

When the operator causes the outer shell of the PHOTOPEN unit to slide forward by pressing the unit against the display screen cover plate, a polished, reflective surface faces the aperture. This surface reflects the light from the diode onto the transistor, causing that photosensitive device to conduct. This condition grounds the input to the output amplifier, making its output fall to a low logic level. The active low-level output remains in effect for as long as the outer housing shell remains pushed forward. As soon as that shell is released, however, the absorbant coating slides back to recover the aperture, shutting off the solid state switch.

HORIZONTAL ENCODER A1B1 ADJUSTMENT PROCEDURE

WARNING

MAKE CERTAIN THAT INPUT POWER IS TURNED OFF AT SOURCE AND TAG "DAGNER, DO NOT OPERATE".

1. Set inpact printer in service position.

2. Remove impact printer paper following procedures of para 6-2.3b.

3. Remove lead from A1TB5-1A and insulate.

* * * *

This is avoid damage to the horizontal driver card due to the printer running into the stops while the encoder is being adjusted.

* * * *

4. Remove back protective cover from horizontal encoder A1B1.

5. Loosen clamp, adjust gap as shown in Figure 6-3.13 View B and tighten clamp.

* * * *

When doing this adjustment the distance specified is approximately equal to an ordinary piece of paper folded in two.

Care must be taken to ensure that if there is a slight wobble in the drive shaft that the encoder disc at no point touches the adjacent surfaces.

* * * *

(CONT'D)

6. Connect oscilloscope channel 1 at AITB5-5A, ground connected to AITB5-8A.

7. Remove "DANGER, DO NOT OPERATE" tag from CDC inptu source and restore power to the CDC.

WARNING

EQUIPMENT OPERATES WITH VOLTAGES CAPABLE OF CAUSING SERIOUS INJURY OR DEATH.
OBSERVE STANDARD SAFETY PRECAUTIONS.

8. Initialise the CDC following procedures of para 5-5.3.

9. Move the print head assembly by hand to cause the encoder to rotate in a counter clockwise direction, and at a constant speed to give a clear wave form.

10. Adjust variable resistor A1A7R6 to obtain a symmetrical square wave display.

11. Connect oscilloscope channel 1 to A1TB5-3A.

12. Adjust variable resistor A1A7R7 to obtain a symmetrical square wave display.

13. Connect oscilloscope channel 2 to A1TB5-5A.

14. Using oscilloscope channel 1 as trigger source, observe wave forms on channels 1 and 2 (Figure 6-3.13 View C).

a. Loosen three mounting screws.

b. Carefully move encoder to obtain wave form shown.

c. Tighten three mounting screws.

(CONT'D)

15. Turn off CDC and tag "DANGER, DO NOT OPERATE".

16. Remove oscilliscope leads.

17. Replace A1B1 protective back cover.

18. Replace lead A1TB5-1A.

19. Return impact printer to normal operating position.

20. Remove "DO NOT OPERATE" tag.

VERTICAL ENCODER A1B2 ADJUSTMENT PROCEDURES

WARNING

MAKE CERTAIN THAT EQUIPMENT INPUT POWER IS TURNED OFF AT SOURCE AND TAG "DANGER, DO NOT OPERATE".

1. Set impact printer in service position.

2. Remove impact printer paper following procedures of para 6-2.3g.

3. Remove back protective cover from vertical encoder A1B2.

4. Loosen clamp (figure 6-3.13 view B), adjust gap as shown, and tighten clamp.

5. Remove lead from terminal board A1TB3-1A and jumper to power supply A3A431 black test point TP (--).

6. Remmove lead from A1TB3-2A and jumper to power supply A3A361 red test point (+5V)

6. Connect oscilloscope channel 1 at vertical encoder A1TB3-5A and connect oscilloscope ground reference at side of A1TB3-8A conncected to ground.

7. Remove "DANDER, DO NOT OEPRATE" tages from CDC input source and restore power to CDC.

WARNING

EQUIPMENT OPERATES WITH VOLTAGES CAPABLE OF CAUSING SERIOUS INJURY OR DEATH.
OBSERVE STANDARD SAFETY PROCEDURES.

(CONT'D)

8. Initiase CDC following procedures of para. 5-3.3. Observe that encoder rotates counter clockwise.

9. Adjust variable resistor A1B2-R6 to obtain a symmetrical square-wave display.

10. Connect oscilloscope channel 1 at A1TB3-3A.

11. Adjust variable resistor A1B2-R7 to obtain a symmetrical sqaure wave display.

12. Connect oscilloscope channel 2 at A1TB3-5A.

13. Using oscilloscope channel 1 trigger source, chopped, observe waveforms on channel 1 and 2 and proceed as follows (see figure 6-3.13 view C):

    a. Loosen three mounting screws.

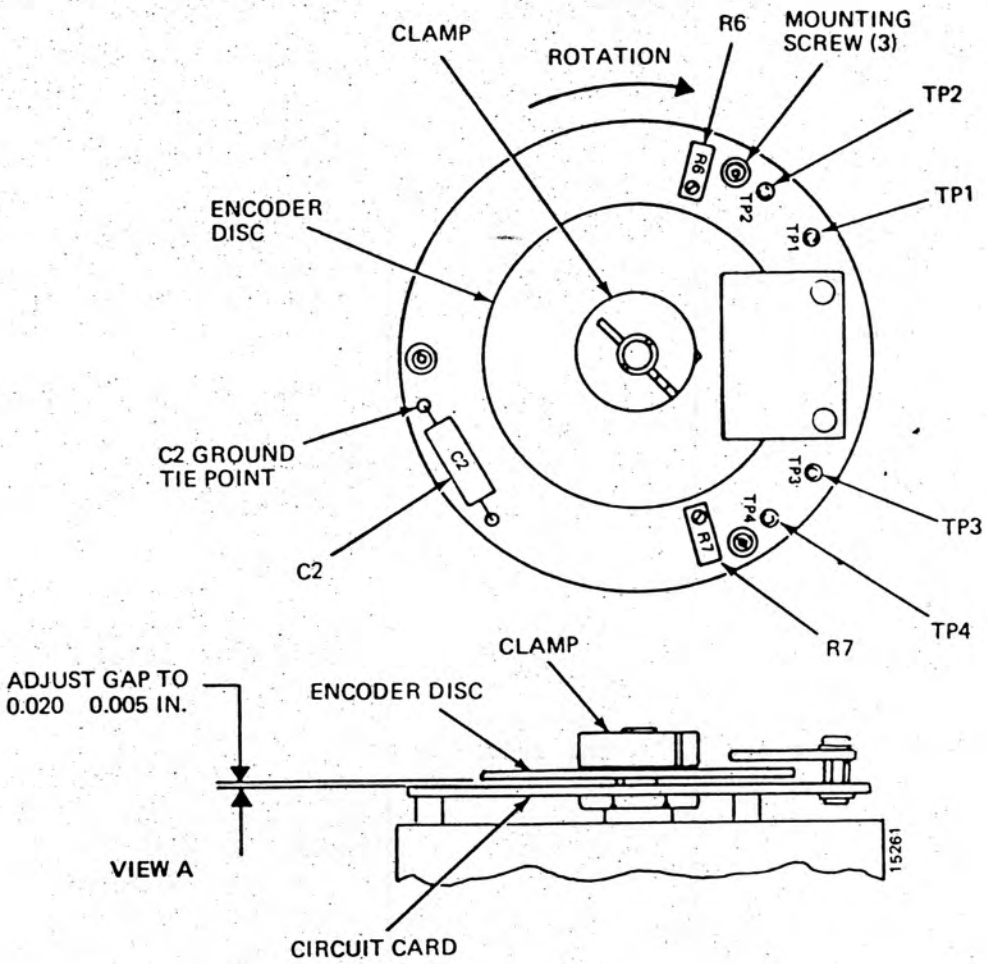
    b. Carefully adjust encoder card to obtain waveform shown.

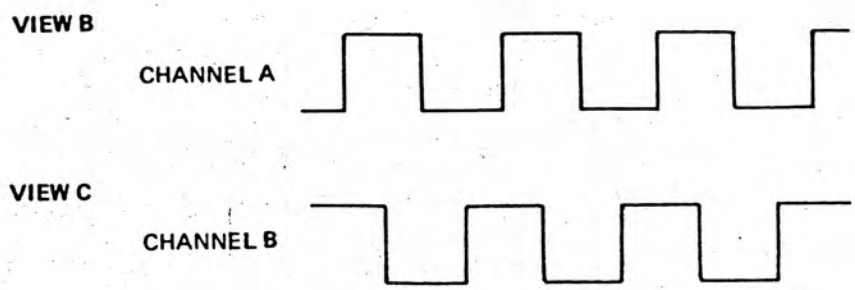
    c. Tighten mounting screws.

14. Remove oscillosope and jumpers and re-install leads at A1TB3-1A and A1TB3-2A.

15. Reinstall encoder back protective cover.

16. Return impact printerto normal operating position.





ENCODER ADJUSTMENT

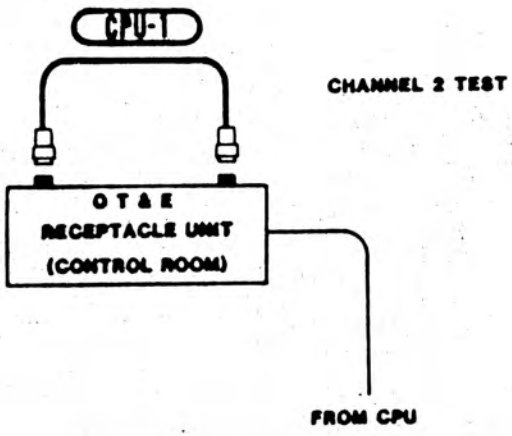
COMMON PRINTER ERRORS

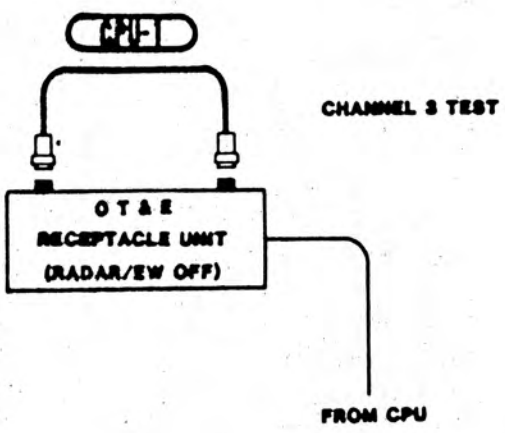
	CAUSE	CURE
Printer slams into stops at high speed.	Encoder out of adjustment.	Perform procedure of 6-3.5. If this does not correct the fault check the encoder graticule disc for damage.
Printer field of print drifts to the	Encoder out of adjustment.	Check the spacing of the encoder graticule disc. Probably set to too great a space. Perform Procedure 6-3.8.
Printer on initialization, drives right and returns, then does not continue to run.	1. No information being supplied to the printer.	Enable ships head or sensor information.
	2. Vertical drive incorrect.	Check that the vertical drive makes a definite space ahead with no backlash, and not change driver card.
Vertical drive runs away.	Encoder out of adjustment.	Perform procedure 6-3.4. If this does not correct the fault check the encoder graticule disc for damage.
Vertical drive jitters or has backlash.	Driver card U/S.	Replace card.
Paper tears repeatedly.	Paper tension or clutch tension incorrect. Tractor spockets misaligned.	Perform procedure 6-3.3.

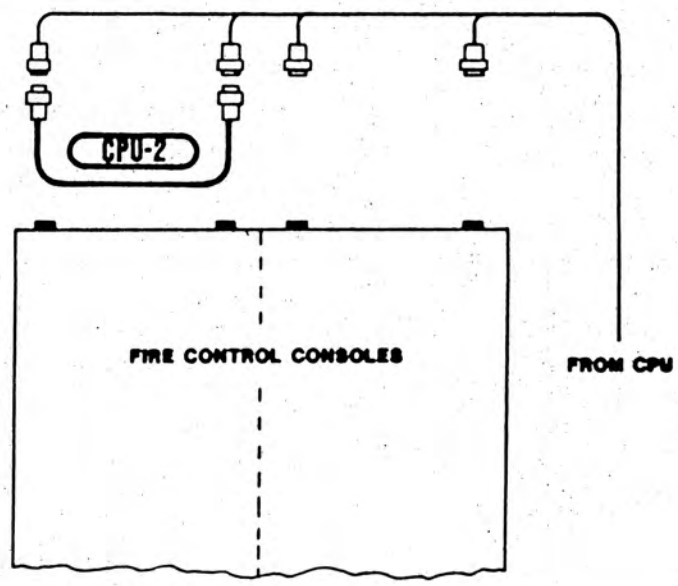
(CONT'D)

	CAUSE	CURE
Missing one or more full lines of information.	1. Hammer drive fuse blown. 2. Possible short in ribbon cable. 3. Stick solenoid.	1. Check fuses. 2. Visually inspect cable for damage. 3. Checl solenoids.
No information written.	1. Fuse blown for tape drive. 2. Cassette assembly jammed. 3. Print head set to far back.	1. Check hammer driver card fuses. 2. Check ribbon cable for damage. 3. Replace cassette assembly. 4. Perform procedure 6-3.2e.
Intermittent printing.	1. Drive screw bowed.	1. Depending on the amount of adjustment available, adjust print head closer to the paper. If not enough adjustment replace drive screw. 2. Inspect ribbon cable.
With printer switched off, the CDC operates correctly, when printer is switched on the the CD EFR light extinguishes and the MPU to CPU address read all zeros.	1. Fuse or fuses blown in driver cards. 2. Drives up in Driver card.	1. Check and replace fuse. 2. Replace card.

CPU I/O CHANNEL TESTING







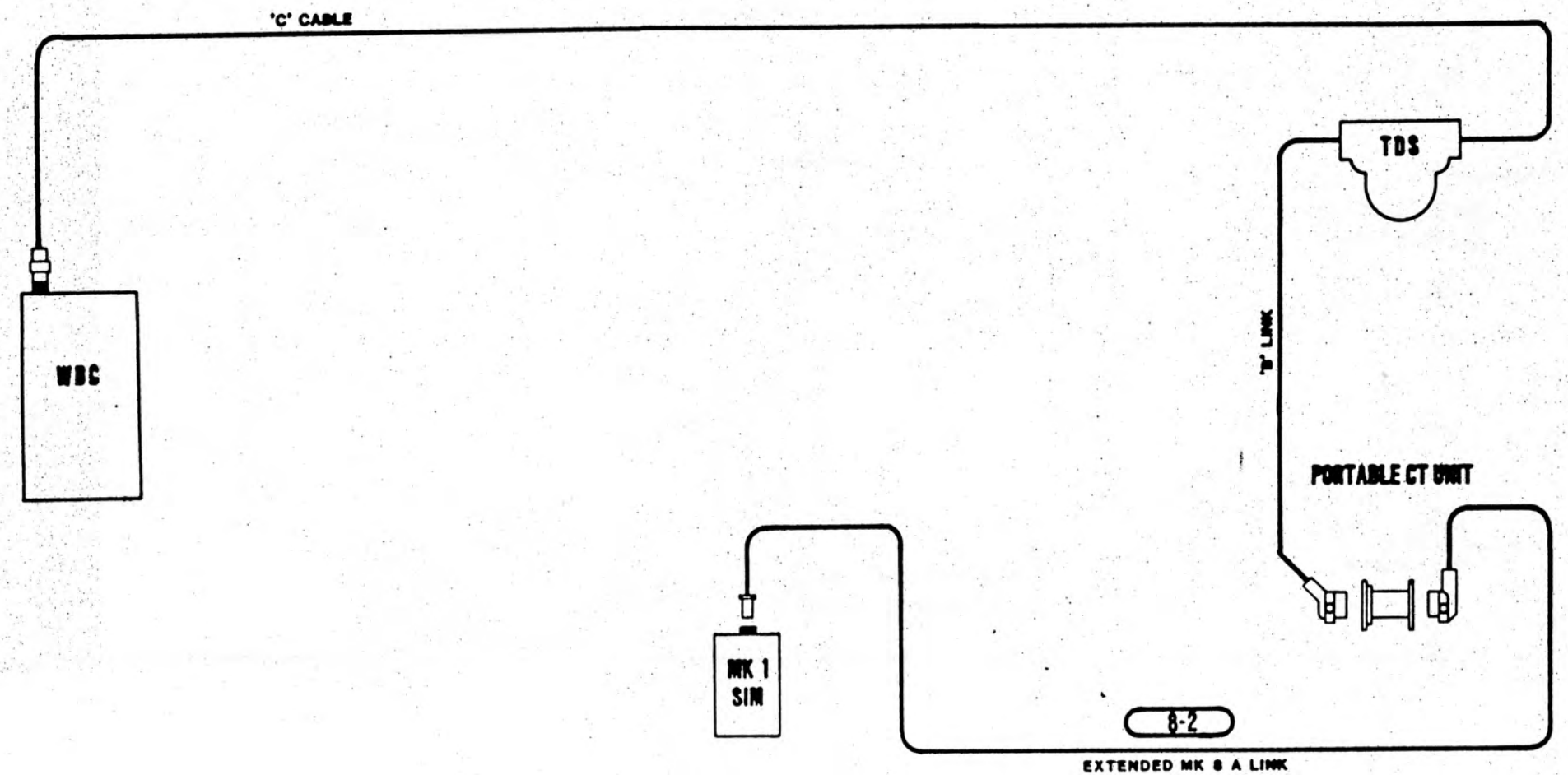
CHANNEL 6 FCC(R) - CONNECT BETWEEN FC 42 (P13) & FC 41 (P14)

CHANNEL 7 FCC(R) - CONNECT BETWEEN FC 12 (P17) & FC 11 (P16)

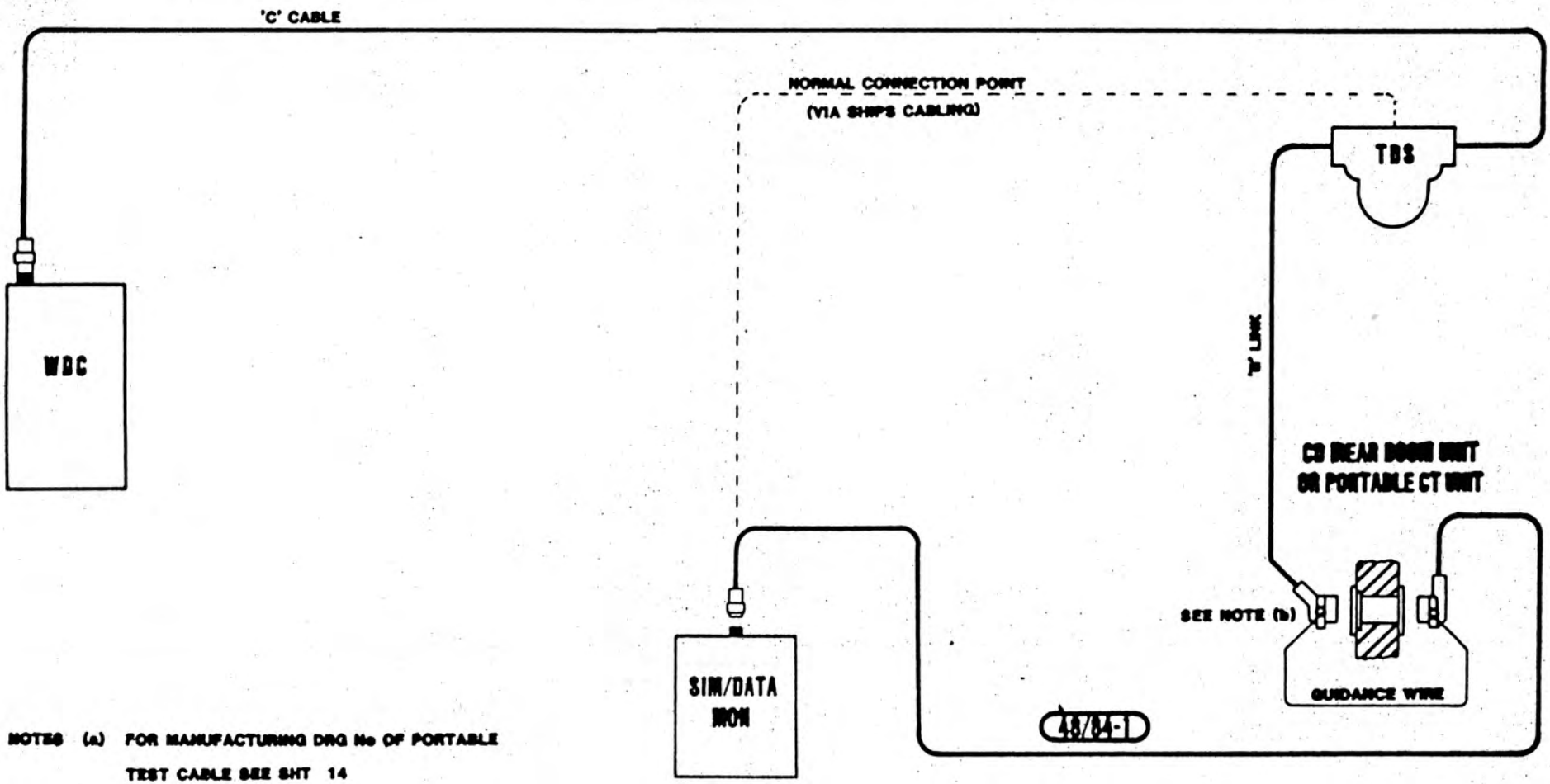
CHANNEL 12 FCC(L) - CONNECT BETWEEN FC 44 (P15) & FC 43 (P16)

CHANNEL 13 FCC(L) - CONNECT BETWEEN FC 16 (P21) & FC 15 (P22)

TORPEDO MK 8 SYSTEM TEST –USING MK 1 SIMULATOR



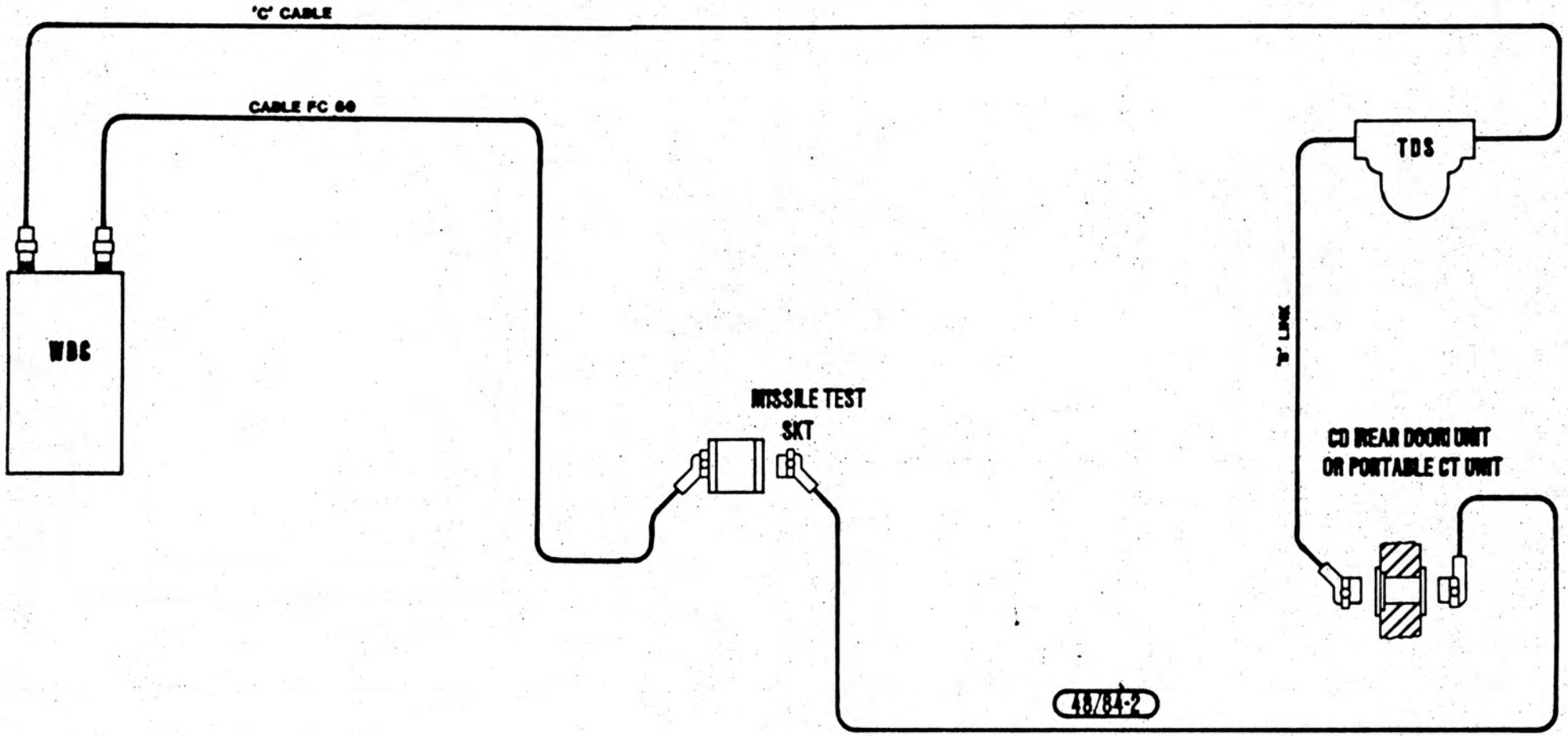
ALTERNATIVE S/DM CONNECTION POINT



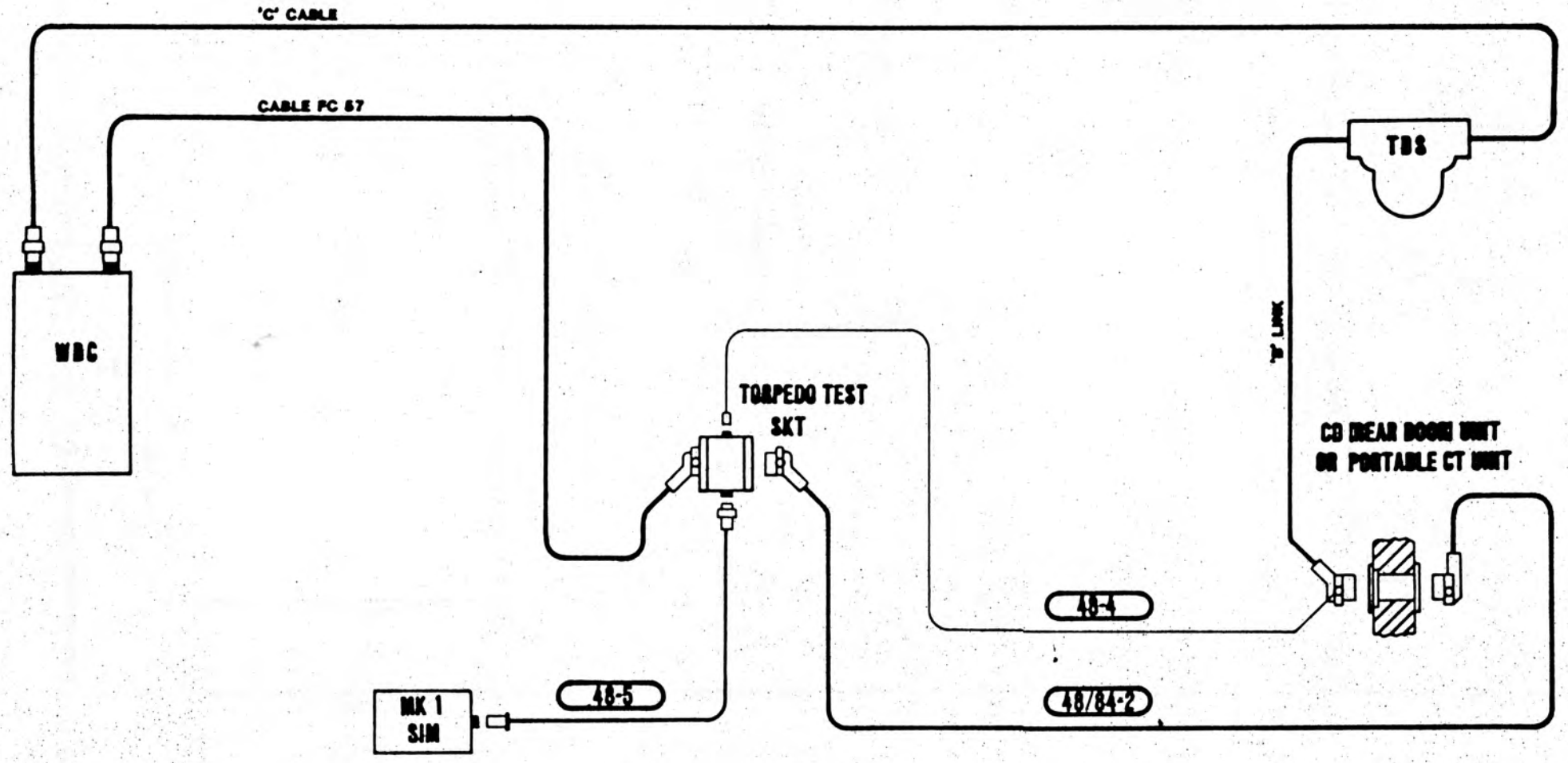
NOTES (a) FOR MANUFACTURING DRG No OF PORTABLE TEST CABLE SEE SHT 14

(b) GUIDANCE WIRE ADAPTER (DSN 5940-66-115-3998) SHALL BE USED TO CONNECT G/W TO HORN OF B LINK PLUG

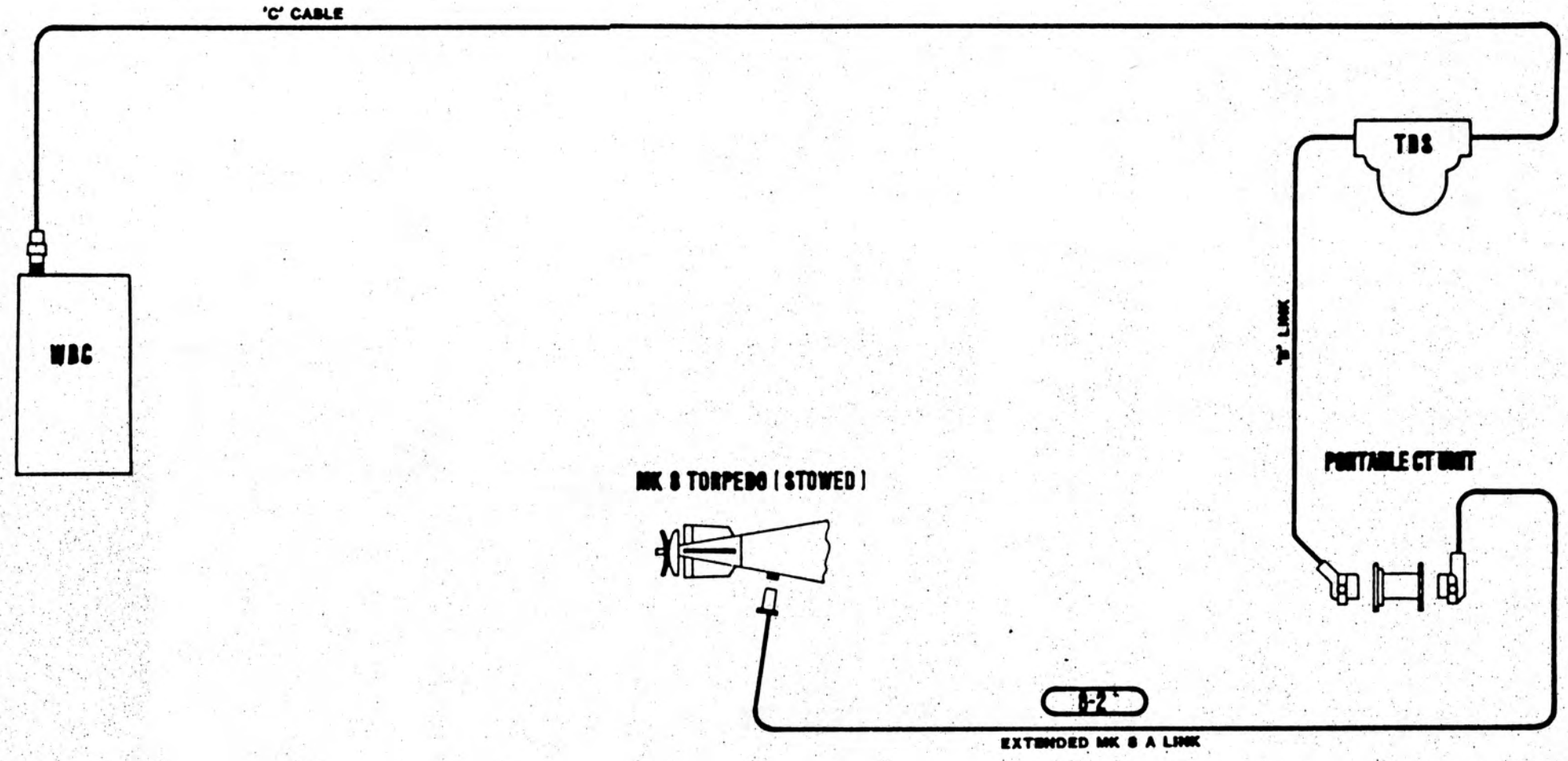
MISSILE UGM-84 SYSTEM TEST-WRAP AROUND



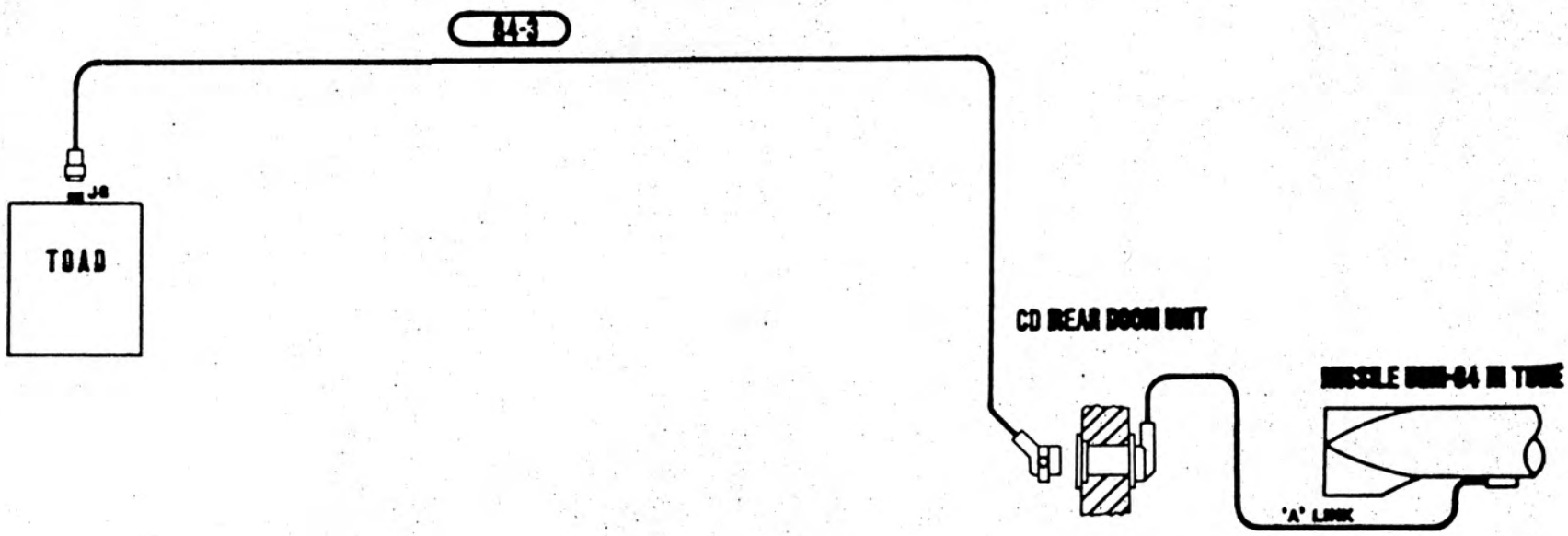
TORPEDO MK 48 SYSTEM TEST-WRAP AROUND



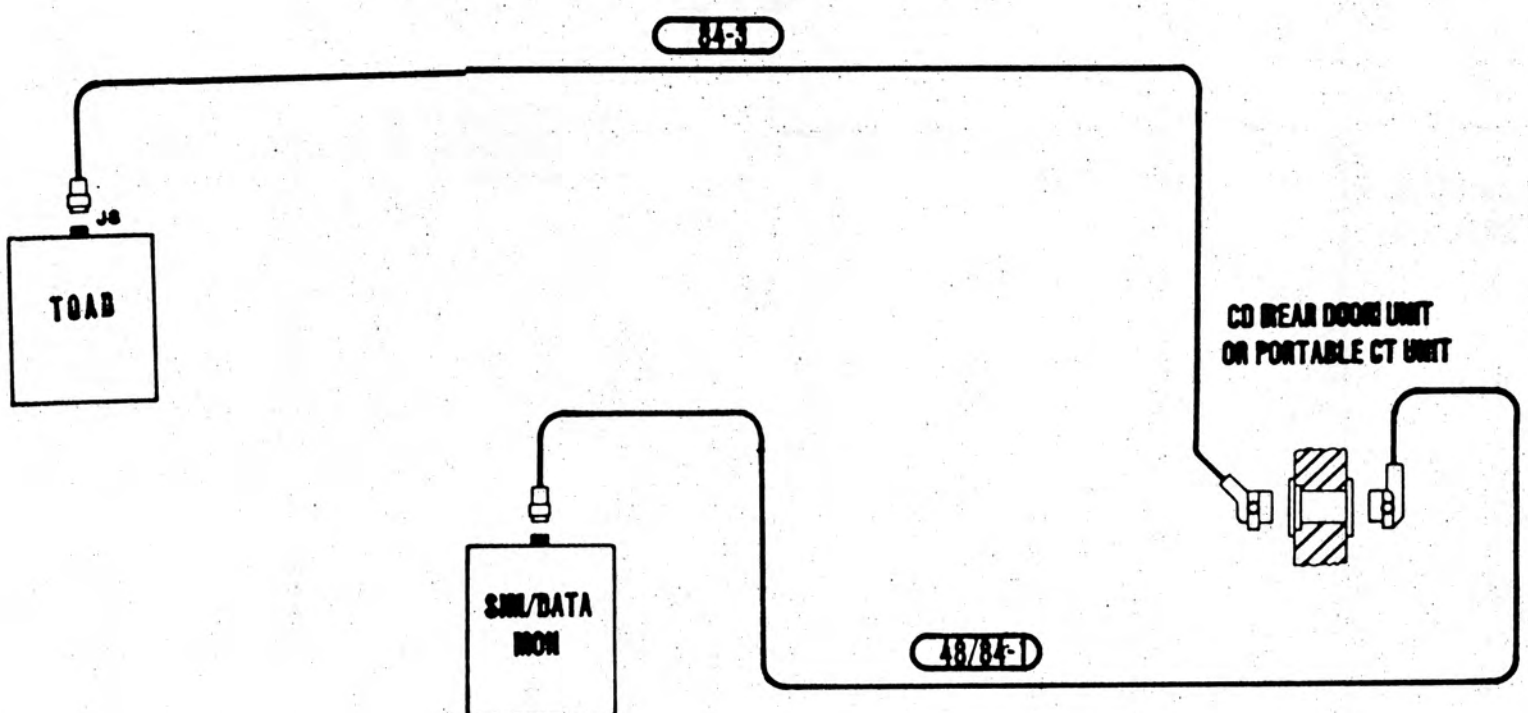
TORPEDO MK 8 SYSTEM TEST –USING STOWED TORPEDO



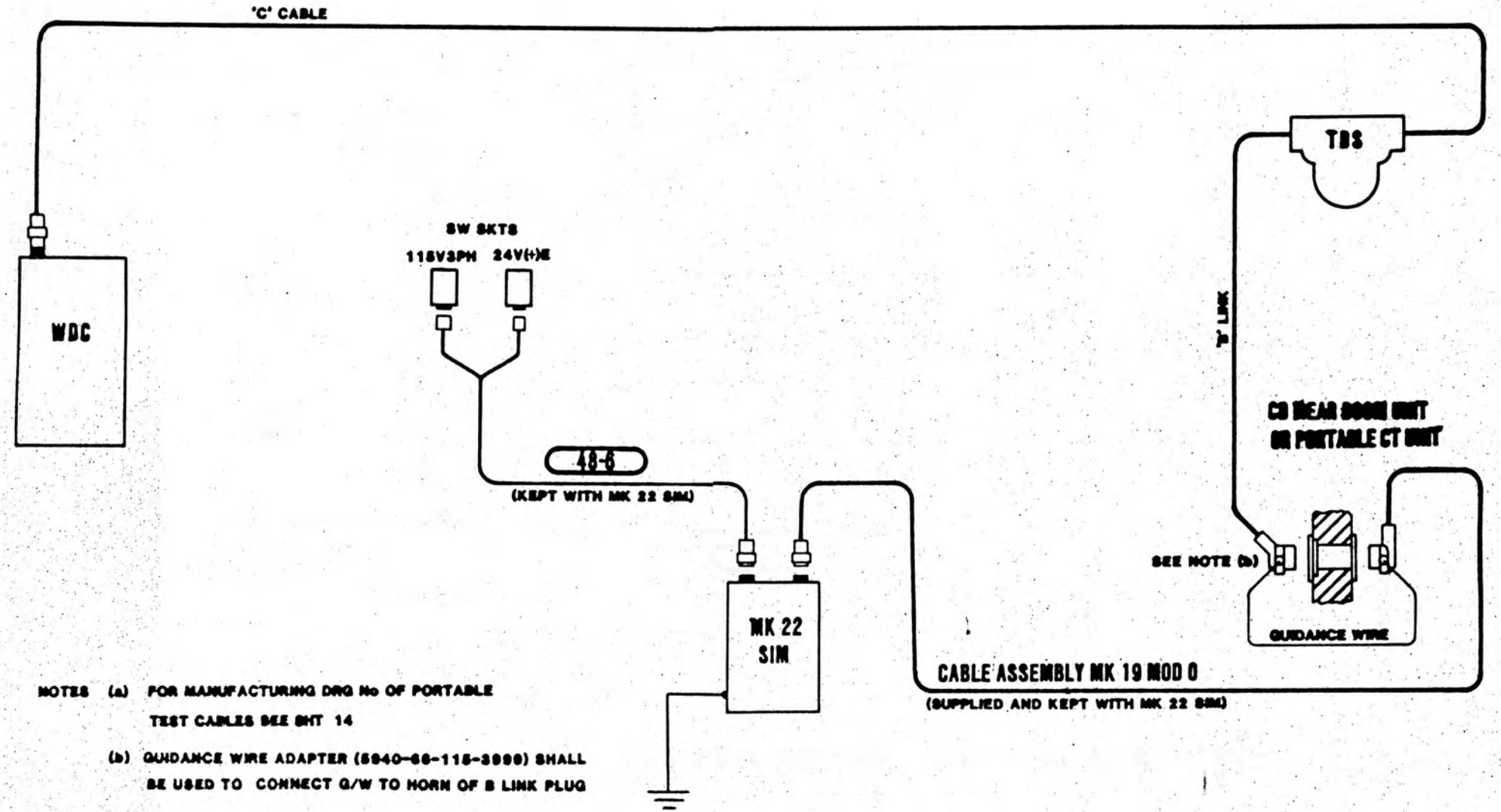
MISSILE UGM-84 CASUALTY FIRING MODE



MISSILE UGM-84 SYSTEM TEST-CASUALTY FIRING MODI



TORPEDO MK 48 SYSTEM TEST–USING MK 22 SIMULATOR



NOTES (a) FOR MANUFACTURING DRG No OF PORTABLE TEST CABLES SEE SHT 14

(b) GUIDANCE WIRE ADAPTER (5940-66-115-3999) SHALL BE USED TO CONNECT G/W TO HORN OF B LINK PLUG

NEW DSN	OLD DSN	MFR PART NO	TYP	DESCRIPTION	SAL	HELD	STOWAGE	SUR	DEF
4140-01-008-2026		7134974-02		FAN	1				
folder 965									
4140-01-010-0615		7133937-00		FAN	0				
folder 960									
4140-66-112-5335		7308013-00		FAN ASSY	0				
folder 971									
5120-66-083-3281		7128012-00		BUSHING GUIDE	0				
folder 956									
5120-66-083-3282		7128013-00		BUSHING GUIDE	0				
folder 957									
5120-66-083-3283		9839225		PIN	0				
folder 984									
5120-66-083-3284		9839224		ADAPTER	0				
folder 985									
5120-66-083-3285		9839226		TIP	0				
folder 986									
5120-66-083-3286		8a1e90		TIP	0				
folder 982									
5330-01-062-1005		7101915-00		RF SHIELD GASKET	0				
folder 952									
5905-01-059-9478		RER60F10R5M		RESISTOR	0				
folder 990									
5905-66-117-1006		7904622-00		RESISTOR	0				
folder 980									
5915-01-020-5984		7904734-00		RF FILTER	0				
folder 978									
5930-00-225-7111				SWITCH TOGGLE	0				
folder 623									
5930-00-584-0552		7904702-07		SWITCH TOGGLE	0				
folder 625									
5930-00-615-1029		7904278-00		SWITCH PUSH	0				
folder 626									
5930-00-615-1030		7904278-03		SWITCH PUSH	0				
folder 627									
5930-00-621-3584		7904733-01		SWITCH TOGGLE	0				
folder 628									
5930-00-631-9227		7904466-07		SWITCH PUSH SPST	0				
folder 629									
5930-00-892-9550		7904702-01		SWITCH TOGGLE	0				
folder 631									
5930-00-892-9714		7902817-02		SWITCH	1				
folder 632									
5930-00-914-7855		7904702-05		SWITCH TOGGLE	0				
folder 633									
5930-00-919-7654		7902817-06		SWITCH MIN	1				
folder 634									
5930-00-943-6612		MS24655-211		SWITCH	0				
folder 635									
5930-01-020-9632		7904366-03		SWITCH TOGGLE	0				
folder 636									
5935-00-088-7661		MS3102R20-1P		CONNECTOR	0				
folder 988									

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SWUP SUPPORT SPARES

NEW DSN	OLD DSN	MFR PART NO	TYP	DESCRIPTION	SAL	HELD	STOWAGE	SUR	DEF
5935-00-498-2807		7902611-01		CONTACT ELECTRICAL	0				
folder 924									
5935-00-754-5036		MS3102-R20-P		CONNECTOR	0				
folder 928									
5935-00-914-0174		MS3120E14-5P		CONNECTOR	0				
folder 939									
5940-00-516-1726		7902636-01		TERMINAL ASSY	0				
folder 935									
5940-01-019-4700		7101870-00		TERMINAL BOARD	0				
folder 929									
5940-66-112-5334		7902684-00		TERMINAL FEED THRU	0				
folder									
5940-66-117-1[illegible]		7902[illegible]-01		INSULATOR TERMINAL	0				
folder									
5940-66-117-1[illegible]		7906[illegible]-01		TERMINAL BOARD	0				
folder 923									
5945-00-932-5215		7902350-00		RELAY ARMATURE	0				
folder 922									
5950-01-092-4[illegible]		7101977-16		CHOKE	0				
folder 938									
5961-00-810-[illegible]		7202219-23		DIODE	0				
folder 927									
5995-01-037-9[illegible]		7150319-01		CABLE ASSY	0				
folder 940									
5999-00-139-8[illegible]		7901698-06		CONTACT	0				
folder 932									
5999-00-255-3195		100-1024P159		CONTACT	0				
folder 926									
5999-00-532-1[illegible]		7050015-00		BUSHING	0				
folder									
5999-00-632-7[illegible]				CONTACT	0				
folder 949				PT No. (100-5102&5994)					
5999-00-741-45[illegible]		7050014-01		CONTACT WW	0				
folder 945									
5999-01-060-91[illegible]		100-1016P159		CONTACT	0				
folder 945									
5999-01-062-7572		7136545-01		NDRO CORD MEMORY	1				
folder 637									
5999-01-075-9123		100-1026P159		CONTACT	0				
folder 947									
5999-01-131-4654		715046-01		CIRCUIT CARD ASSY	1				
folder 604									
6210-00-611-9451		7904735-23		LIGHT IND NEO	0				
folder 639									
6210-00-611-9452		7904735-20		LIGHT IND NEO	0				
folder 640									
6210-00-611-9585		7904279-12		LIGHT INDICATOR	0				
folder 641									
6210-00-611-9586		7904279-00		LIGHT INDICATOR	0				
folder 642									
6210-01-010-0959		7904806-00		LIGHT INDICATOR INC	0				
folder 643									

NEW DSN	OLD DSN	MFR PART NO	TYP	DESCRIPTION	SAL	HELD	STOWAGE	SUR	DEF
6210-01-066-5573		7904467-14		LIGHT INDICATOR	0				
folder 644									
6350-66-117-1000		7904742-01		HORN ELECTRICAL	0				
folder 934									
6645-00-255-1301				METER TIME TOTALLING	0				
folder 986				PT No (MIL MS17322-10)					
7010-00-397-7[illegible]		7125311-01		PCA P/C M REG	1				
folder 63									
7010-00-397-7[illegible]14		7126155-01		PCA SP MEMORY IF(INTER CH	1				
folder 645				WITH 7010-66-108-5187)					
7010-00-522-3[illegible]0		7092175-01		PCA ALU	1				
folder									
7010-00-522-3[illegible]		7092[illegible]-01		PCA (INTER / CHANGEABLE	1				
folder				WITH 7010-01-084-6742					
7010-00-522-3[illegible]0		7092[illegible]-01		PCA BCH CONT	1				
folder 671									
7010-00-522-3[illegible]1		7092200-01		PCA REP CONT (INTER CHANG	1				
folder 629				WITH 7010-01-084-6742)					
7010-00-522-3[illegible]		7118318-01		PCA 32 CN REG (INTER CHAN	1				
folder 655				WITH 7010-66-108-5184)					
7010-00-522-3[illegible]		7119380-01		PCA IF NTDS F	1				
folder 634									
7010-00-522-3[illegible]		7119395-01		PCA IF NTDSF	1				
folder 641									
7010-00-522-3[illegible]6		7119[illegible]-01		PCA IF NTDSF	1				
folder 544									
7010-00-522-3702		7125136-01		PCA DIAGN ROM	1				
folder 546									
7010-00-522-3[illegible]4		7125[illegible]-01		PCA ECW W/M P	1				
folder 95									
7010-00-522-3715		7125240-01		PCA 1 REG 0-7 (INTER CHAN	1				
folder 550				WITH 7010-01-076-0613)					
7010-00-522-3719		7125290-01		PCA I/O C MEM	1				
folder 881									
7010-00-522-3721		7125306-01		PCA I/O C MEM (INTER CHAN	1				
folder 553				WITH 7010-66-108-5193)					
7010-00-522-3732		7125380-01		PCA PSW	1				
folder 557									
7010-00-522-3735		7125500-01		PCA SHIFT MTR	1				
folder 56[illegible]									
7010-00-522-3749		7125666-01		PCA SP MEM C	1				
folder 562									
7010-00-522-3752		7150320-01		PCA CLOCK	1				
folder 566									
7010-00-522-3759		7126125-01		CIRCUIT CARD ASSY	1				
folder 621									
7010-00-522-3760		7126130-01		CIRCUIT CARD ASSY	1				
folder 629									
7010-00-522-3771		7126151-01		PCA I/O DD/MC(INTER CHANG	1				
folder 587				WITH 7010-66-100-4230)					
7010-00-522-3[illegible]		7126160-01		PCA MN CI RES	1				
folder 58									

NEW DSN	OLD DSN	MFR PART NO	TYP	DESCRIPTION	SAL	HELD	STOWAGE	SUR	DEF
7010-00-522-3967		7126175-01		PCA I/O PRTY	1				
folder 571									
7010-00-522-4004		7126181-01		PCA PRTY	1				
folder 572									
7010-00-522-4005		7150420-01		PCA INT STOR(INTER CHANGE	1				
folder 573				WITH 7010-66-108-5185)					
7010-00-522-4239		7126200-01		PCA 20MZ OSC	1				
folder 574									
7010-00-522-4253		7126207-01		PCA(INTER CHANGEABLE WITH	1				
folder 575				7010-66-100-4239)					
7010-00-525-1419		7126221-01		PCA MULTI CNTR	1				
folder 576									
7010-00-578-2304		7126301-01		PCA MEMORY M/P	1				
folder 617									
7010-00-578-2410		7126381-01		CIRCUIT CARD ASSY(INTERCH	1				
folder 620				WITH 7010-66-100-5184)					
7010-00-578-2416		7126412-01		PCA ALU 2	1				
folder 609									
7010-00-604-8080		7133610-02		CABLE ASSY	0				
folder 958									
7010-00-604-9077		7133804-01		CABLE ASSY	0				
folder 955									
7010-00-610-2819		7134939-00		CABLE ASSY	0				
folder 961									
7010-00-611-9209		7134945-00		CHOKE	0				
folder 964									
7010-01-003-6384		7136350-01		PCA MIC 15(INTER CHANGEAB	1				
folder 610				WITH 7010-66-100-3321)					
7010-01-006-6468		7136275-01		PCA NDRO P IF 71362	1				
folder 914									
7010-01-009-0711		7134940-00		CABLE ASSY	0				
folder 962									
7010-01-017-8766		7126066-01		PCA EXT REG MATH PAK	1				
folder 613									
7010-01-018-9922		7136265-01		PCA ALU CON I(INTER CHANG	1				
folder 615				WITH 7010-66-100-3320)					
7010-01-026-8023		7134998-00		CABLE ASSY	0				
folder 966									
7010-01-037-9651		7101963-01		CABLE ASSY	0				
folder 953									
7010-01-037-9652		7101966-01		CABLE ASSY	0				
folder 954									
7010-01-037-9653		7134942-00		CABLE ASSY	0				
folder 963									
7010-01-050-1708		7150415-01		PCA	1				
folder 616									
7010-01-053-4303		7150395-01		PCA XLATOR	1				
folder 617									
7010-01-054-2891		7150405-01		PCA SH MTRX C	1				
folder 618									
7010-01-075-5597		7125307-01		INSTRUCTION REG	1				
folder 611									

NEW DSN	OLD DSN	MFR PART NO.	TYP	DESCRIPTION	SAL	HELD	STOWAGE	SUR	DEF
7010-01-084-7596		7150383-02		FAN	0				
folder 969									
7010-01-084-8742		7092201-01		CIRCUIT CARD ASSY	1				
folder 630									
7010-01-084-8785		7126172-01		CIRCUIT CARD ASSY	1				
folder 646									
7010-01-100-3010		7125267-01		CIRCUIT CARD ASSY	1				
folder 636									
7010-01-100-3318		7126156-01		CIRCUIT CARD ASSY	1				
folder 649									
7010-01-100-3320		7136266-01		CIRCUIT CARD ASSY	1				
folder 908									
7010-01-100-3321		7136351-01		CIRCUIT CARD ASSY	1				
folder 924									
7010-01-100-3324		7150421-01		CIRCUIT CARD ASSY	1				
folder 570									
7010-01-100-3325		7150475-01		CIRCUIT CARD ASSY	1				
folder 635									
7010-01-100-3326		7150480-01		CIRCUIT CARD ASSY	1				
folder 606									
7010-01-167-2550		7313550-03		CIRCUIT CARD ASSY	1				
folder 922									
7010-01-168-8593		7310022-18		CIRCUIT CARD ASSY	1				
folder 612									
7010-66-108-5401		7150350-01		POWER SUPPLY	1				
folder 968									
7021-66-114-0714		7310510-01		CIRCUIT CARD ASSY	1				
folder 614									
7021-66-114-0715		7310512-01		CIRCUIT CARD ASSY	1				
folder 619									
7021-66-114-0716		7310514-01		CIRCUIT CARD ASSY	1				
folder 915									
7021-66-114-0717		7310516-01		CIRCUIT CARD ASSY	1				
folder 916									
7021-66-114-0718		7310518-01		CIRCUIT CARD ASSY	1				
folder 917									
7021-66-114-0719		7310520-01		CIRCUIT CARD ASSY	1				
folder 918									
7021-66-114-0721		7310534-01		CIRCUIT CARD ASSY	1				
folder 919									
7021-66-114-0722		7310536-01		CIRCUIT CARD ASSY	1				
folder 920									
7021-66-114-0724		7312682-05		CIRCUIT CARD ASSY	1				
folder 921									

NEW DSN	OLD DSN	MFR PART NO.	TYP	DESCRIPTION	SAL	HELD	STOWAGE	SUR	DEF
1220-00-403-7176				POWER SUPPLY 5V DC	1				
folder 712				10 AMP					
1220-01-022-6991	1220-66-092-4789			POWER SUPPLY 28V DC 4AMP	1				
folder 713									
1220-66-092-4[illegible]		L535-300-282		FOCUS SUPPLY	1				
folder 714									
1220-66-100-1[illegible]		L535-990-046	CMC	ROW/COL DRI	2				
folder [illegible]									
1220-66-100-1[illegible]		L535-005-160		PRI CON CKT	1				
folder 716									
1220-66-100-[illegible]		L535-300-511		MK23 W/G CO	1				
folder [illegible]									
1220-66-101-7[illegible]		L200-024-411		MATRIX PRINTHEAD	1				
folder [illegible]									
1220-66-101-[illegible]		L200-024-412		CASSETTE ASSY	2				
folder [illegible]									
1220-66-101-7[illegible]		L200-024-532		TRACTOR ASSY	1				
folder 721									
1220-66-101-7[illegible]		L535-300-534		PCB SERVO ENCODER SENSOR	1				
folder [illegible]									
1220-66-113-[illegible]		L200-024-510		PLOTTING PAPER	[illegible]				
folder [illegible]									
1220-66-113-[illegible]				CABLE FOR CDC HAMMER	1				
folder [illegible]				DRIVE TO PRINTHEAD					
1230-01-079-[illegible]	6110-66-092-4812			REGULATOR 5 VOLT	1				
folder [illegible]									
1230-01-079-[illegible]	1220-66-100-1871	L535-990-048	MDP	TRANSLATE DRIVER	2				
folder 724									
1230-01-079-[illegible]	1220-66-100-1872	L535-995-067	JHD	MULTIPLEXER	2				
folder [illegible]									
1230-01-079-[illegible]	1220-66-100-1874	L535-995-110	MDM	RECEIVER INT	1				
folder 726									
1220-01-079-[illegible]	1220-66-100-1875	L535-995-109	MDL	DRIVER INTERFACE	1				
folder 727									
1230-01-079-[illegible]	1220-66-100-1876	L535-990-012	TSS	TEMP SENSOR	1				
folder 728									
1230-01-079-[illegible]	1220-66-100-1878	L535-995-066	BHL	MULTIPLEXER	1				
folder 729									
1230-01-079-[illegible]	1220-66-100-1879	L535-995-022	ABE	DIODE NETWORK	1				
folder 730									
1230-01-079-[illegible]	1220-66-100-1925	L535-995-187	SHU	GEN FUNCT	1				
folder 731									
1230-01-079-[illegible]	1220-66-100-1918	L535-995-039	KBC	ADDER	1				
folder 732									
1230-01-079-[illegible]	1220-66-100-1920	L535-995-055	KDM	DIFF DRI	1				
folder 733									
1230-01-079-[illegible]	1220-66-100-1921	L535-995-053	KDN	DIFF LI REC	1				
folder 734									
1230-01-079-[illegible]	1220-66-100-1922	L535-995-144	KMA	QUAD SELECT	1				
folder 735									
1230-01-079-[illegible]	1220-66-100-1923	L535-995-145	KMB	PROC INP SD	1				
folder 736									

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NEW DSN	OLD DSN	MFR PART NO.	TYP	DESCRIPTION	SAL	HELD	STOWAGE	SUR	DEF
1230-01-079-3803 folder 737	1220-66-100-1924	L535-995-146	KMC	PROC REF SD	1				
1230-01-079-3804 folder 923		L535-995-186	SHY	GENERATOR FUNCTION	1				
1230-01-082-2706 folder 738	1220-66-100-1919	L535-990-052	GMM	2 STATE DRIVER	1				
1230-01-082-2938 folder 739	1220-66-100-1927	L535-990-048	FMF	RESISTOR NETWORK	1				
1230-01-082-2942 folder 382	6130-66-100-1954	L535-300-515		POWER SUPPLY PORM 60V	1				
1230-01-082-2943 folder 481	1220-66-100-1956	L535-990-054	RMB	RES MODULE	1				
1230-01-083-0749 folder 489	1220-66-100-1959	L535-300-519		DECO/RGLE	1				
1285-01-111-6479 folder 868		L200-024-524		PEN LIGHT RECEIVING	1				
1290-01-061-7015 folder 486	1220-66-092-4751	L535-990-038	RHF	NAND GATE 12-2 INPUT	3				
1290-01-061-7014 folder 487	1220-66-092-4752	L535-990-041	AFA	DECODER 1 OF 8	2				
1290-01-061-7015 folder 488	1220-66-092-4753	L535-990-028	DRL	BUFFER BIDIRECTIONAL	2				
1290-01-061-7016 folder 489	1220-66-092-4754	L535-990-035	GHK	FLIP FLOP J-K DAR	2				
1290-01-061-7017 folder 490	1220-66-092-4755	L535-990-044	NFM	SHIFT REGISTER	3				
1290-01-061-7018 folder 491	1220-66-092-4756	L535-990-037	BHA	COUNTER UP DOWN/BIN	1				
1290-01-061-7019 folder 492	1220-66-092-4757	L535-990-049	FFG	COMPARATOR	1				
1290-01-061-7715 folder 493	1220-01-061-7715	L535-990-034	RHG	INVERTER	2				
1290-01-061-9385 folder 494	1220-66-092-4770			D-A CONVECONT LOGIC	1				
1290-01-061-9386 folder 495	1220-66-092-4771	L414-000-126		MAJOR DEFLECTION AMP(INC) L535-300-289/L535-300-290	1				
1290-01-062-0088 folder 496	1220-66-092-4742	L535-990-031	DRH	MICRO PROCESSOR	1				
1290-01-062-0089 folder 497	1220-66-092-4743	L535-990-030	DRN	INTERFACE MICROPROCESSOR	3				
1290-01-062-0091 folder 498	1220-66-092-4746	L535-990-029	DRJ	CLOCK MICROPROCESSOR	1				
1290-01-062-0092 folder 499	1220-66-092-4747	L535-990-043	NFE	INTERFACE SCHMITT TRIGGER	2				
1290-01-062-0093 folder 500	1220-66-092-4748	L535-990-026	NHF	RECEIVER NTDS FAST	2				
1290-01-062-0096 folder 501	1220-66-092-4760			LOGIC MODULE HIGH SPEED	1				
1290-01-062-0098 folder 502	1220-66-092-4791			SECTOR COMPARE	1				
1290-01-062-0099 folder 503	1220-66-092-4792			SECTOR TIMING	1				

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NEW DSN	OLD DSN	MFR PART NO	TYP	DESCRIPTION	SAL	HELD	STOWAGE	SUR	DEF
1290-01-062-0100 folder 504	1220-66-092-4793			TRACK AND DISC	1				
1290-01-062-0101 folder 505	1220-66-092-4795	L535-300-267		STATUS SELECT	1				
1290-01-062-0117 folder 506	1220-66-092-4774	L535-990-039	CHP	GATE NAND 4.8 INPUT	1				
1290-01-062-0118 folder [illegible]	1220-66-092-4776	L535-990-051	GBP	D-A CONVERTER	1				
1290-01-062-0119 folder 511	1220-66-092-4782			BUFFER +30V	1				
1290-01-062-0120 folder 515	1220-66-092-4783	L535-990-045	GKR	MULTI-STATE SETTING CIRC	1				
1290-01-062-0[illegible] folder [illegible]	1220-66-092-4785	L535-300-504		MULTI-STATE READBACK	1				
1290-01-062-0123 folder 516	1220-66-092-4786			MK48 W-0 DIAGNOSTIC	1				
1290-01-062-0124 folder 519	1220-66-092-4788			DISC INTERFACE	1				
1290-01-062-0[illegible] folder 521	1220-66-092-4772			FOCUS LAMP	1				
1290-01-062-[illegible] folder [illegible]	1220-66-092-4766			LINEARITY CORRECTOR	1				
1290-01-062-[illegible] folder 24	1220-66-092-4768			MINOR D-A	1				
1290-01-062-0[illegible] folder 526	1220-66-092-4796			ERROR	1				
1290-01-062-0[illegible] folder 527	1220-66-092-4797			REQUEST	1				
1290-01-062-0[illegible] folder 529	1220-66-092-4798			INTERRUPT	1				
1290-01-062-0[illegible] folder 530	1220-66-092-4761			CATHODE VIDEO AMPLIFIER	1				
1290-01-062-0775 folder 532	1220-66-092-4762			GRID VIDEO AMPLIFIER	1				
1290-01-062-0776 folder 534	1220-66-092-4763	L535-300-265		SUN AMPLIFIER	1				
1290-01-062-0777 folder 536	1220-66-092-4764			VIDEO D-A AND GAMMA CORRECTOR	1				
1290-01-062-0778 folder 538	1220-66-092-4765			PHOSPHOR PROTECTION	1				
1290-01-062-0779 folder 539	1220-66-092-4808			DRIVER MOTOR	1				
1290-01-062-0780 folder 669	1220-66-092-4809			DRIVER HAMMER	1				
1290-01-062-0784 folder 670	1220-66-092-4777			POWER AMPLIFIER	1				
1290-01-062-0785 folder 671	1220-66-092-4779			MK23 WG READBACK	1				
1290-01-062-0786 folder 672	1220-66-092-4780			GYRO PROCESSOR	1				
1290-01-062-0[illegible] folder 673	1220-66-092-4781			POWER SUPPLY 38V DC 10A	1				

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NEW DSN	OLD DSN	MFR PART NO.	TYP	DESCRIPTION	SAL	HELD	STOWAGE	SUR	DEF
1290-01-062-0788	1220-66-092-4784			DATA FILTER	1				
folder 674									
1290-01-062-0789	1220-66-092-4790			TRACK SELECT	1				
folder 675									
1290-01-062-8088	1220-66-092-4794			COMMAND	1				
folder 676									
1290-01-063-1146	1220-66-092-1146			DECODER TELECOM	1				
folder 677									
1290-01-112-8765	1220-66-102-7113	L414-000-129		MODULE ASSY	1				
folder 664									
1290-01-112-8989	1220-66-102-7115	L414-000-130		MODULE ASSY RELAY	1				
folder 665									
1290-01-112-8990	1220-66-102-7116	L414-000-132		MODULE ASSY DIAGNOSIS	1				
folder 67									
1290-01-112-8991	1220-66-102-7117	L414-000-131		MODULE ASSY	1				
folder 666									
3010-01-111-5259	1220-66-102-6821	L316-000-188		CLUTCH FRICTION	1				
folder 678									
3020-01-114-8810	3020-66-102-6834	L344-004-202		PULLEY FLANGED TIMING BELT	1				
folder 679									
3030-00-435-8013	3030-1-113-3040	T200-045-204		BELT DRIVE	1				
folder 682									
3030-01-111-5244	3030-66-102-6853	T200-045-202		BELT DRIVE	1				
folder 680									
3030-01-111-5245	3030-66-102-6854	T200-045-203		BELT DRIVE	1				
folder 681									
5340-01-113-3421	5360-66-102-6816			SPRING RETAINING	1				
folder 683									
5360-00-897-5730		L309-001-459		SPRING	1				
folder 684									
5845-01-039-1913	7035-66-092-4820			BLOCK DETECTOR	1				
folder 685									
5845-01-039-1923	6680-66-092-4816	L535-005-153		TACHOMETER	1				
folder 686									
5845-01-039-2052	1220-66-092-4814	L535-005-151		POWER AMPLIFIER	1				
folder 668									
5845-01-039-2357	1220-66-092-4811			FAIL SAFE	1				
folder 687									
5845-01-039-2713	1220-66-092-4817			CONTROL LOGIC	1				
folder 688									
5845-01-039-2714	1220-66-092-4818			ENCODER LOGIC	1				
folder 689									
5845-01-039-2715	7035-66-092-4819			READ WRITE DETECTOR	1				
folder 691									
5845-01-039-2716	7035-66-092-4821			DUAL DECODER	1				
folder 692									
5845-01-039-2717	7035-66-092-4822			CLOCK GENERATOR	1				
folder 693									
5845-01-039-2754	1220-66-092-4815			SERVO AMPLIFIER	1				
folder 694									
5865-01-036-2509	1220-66-092-4813			POWER SUPPLY	1				
folder 695									

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NEW DSN	OLD DSN	MFR PART NO	TYP	DESCRIPTION	SAL	HELD	STOWAGE	SUR	DEF
5895-01-062-0090	1220-66-092-4745	L535-990-027	EHK	DRIVER 3 STATE	3				
folder 696									
5895-01-062-0094	1220-66-092-4749	L535-990-036	FEA	COUNTER BIN SYNCHRO	3				
folder 697									
5895-01-062-0097	1220-66-092-4758	L535-990-040	CHH	GATE NAND 4.3-3.4 INPUT	2				
folder 698									
5905-00-006-6980		RLR05C101GM		RESISTOR FXD FILM	2				
folder 906									
5905-00-240-2728		L604-044-582		RESISTOR FXD FILM	3				
folder 911									
5905-00-552-5478	5905-00-023-4838			RESISTOR VARIABLE	1				
folder 699				1 00K OHMS \10 00%					
5905-00-761-6727		L604-044-070		RESISTOR FXD FILM	2				
folder 907									
5905-66-101-7288		T566-010-501		RESISTOR NETWORK	1				
folder 700									
5905-66-101-7377		T566-010-502		RESISTOR NETWORK	1				
folder 876									
5905-66-124-8795		T566-011-123		RESISTOR NETWORK	1				
folder 886									
5905-66-124-8795		T566-010-343		RESISTOR NETWORK 33. OHMS	1				
folder 876									
5905-66-124-8850		L604-045-529		RESISTOR FXD FILM	1				
folder 909									
5905-66-124-8851		L604-018-472		RESISTOR FXD	1				
folder 910									
5920-00-004-0274		FM04-1A		FUSE CARTRIDGE	5				
folder 659									
5920-00-221-8371		FM04-5A		FUSE CARTRIDGE	5				
folder 661									
5920-00-413-1328		FM04-3A		FUSE CARTRIDGE	5				
folder 660									
5920-01-030-0615		L414-000-072		MODULE OVER-VOLTAGE	1				
folder 702				PROTECT					
5925-01-029-3012		T505-004-922		CIRCUIT BREAKER MAGNETIC	1				
folder 703				4AMP					
5925-01-050-1182		T505-004-942		CIRCUIT BREAKER MAGNETIC	1				
folder 704				10 AMP					
5925-66-101-7089		T505-004-932		CIRCUIT BREAKER MAGNETIC	1				
folder 705				0.50 AMP					
5925-66-102-5206		T504-004-934		CIRCUIT BREAKER 2 AMP	1				
folder 706									
5925-66-102-6109		T505-004-920		CIRCUIT BREAKER MAGNETIC	1				
folder 707				3 AMP					
5925-66-102-6486		T505-004-907		CIRCUIT BREAKER MAGNETIC	1				
folder 708				5 AMP					
5925-66-102-6487		T505-004-914		CIRCUIT BREAKER 15 AMP	1				
folder 709									
5925-66-102-6488		T505-004-923		CIRCUIT BREAKER MAGNETIC	1				
folder 710				6 AMP					
5925-66-102-6489		T505-004-938		CIRCUIT BREAKER MAGNETIC	1				
folder 711									

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NEW DSN	OLD DSN	MFR PART NO.	TYP	DESCRIPTION	SAL	HELD	STOWAGE	SUR	DEF
5930-01-020-3320		318488		SWITCH PUSH BUTTON	1				
folder 507									
5930-01-022-6984		3184970-0002		SWITCH PUSH BUTTON	1				
folder 508									
5930-01-044-8733		L507-001-916		SWITCH PUSH BUTTON	4				
folder 881									
5930-01-107-0915	5930-66-102-6441	L507-001-727		SWITCH THERMOSTATIC	1				
folder 809									
5930-66-101-7292		T314-012-412		HOUSING SWITCH INDIC	1				
folder 512				SEALED					
5930-66-101-7293		T314-012-413		HOUSING SWITCH INDIC	1				
folder 514				SEALED					
5930-66-101-7294		T314-012-418		HOUSING SWITCH INDIC					
folder 515				SEALED					
5930-66-101-7886		317-9180-000		SWITCH PG MOMENTY	1				
folder 517				MINI SPDT					
5930-66-102-5244		T314-012-433		HOUSING SWITCH INDICATOR	1				
folder 520									
5930-66-124-8705		L507-001-980		SWITCH AND INDICATOR ASSY	1				
folder 880									
5930-66-124-8717		L507-001-982		SWITCH ROTARY	1				
folder 884									
5945-01-045-7266		9324-8213		CONTACTOR 115V	1				
folder 523				LEACH TYPE					
5945-01-081-6402	1220-66-100-1917	L535-990-042	RRF	RELAY MODU	1				
folder 525									
5945-01-117-6774	5945-66-101-7542	T50-004-602		RELAY ARMATURE 4 PDT	1				
folder 528									
5945-01-129-2083	5945-66-101-7545	L503-001-584		RELAY MAGNETIC	1				
folder 531									
5945-66-124-8860		L503-300-001		RELAY TIME DELAY	1				
folder 912									
5950-01-020-3336		3184756		TRANSFORMER POWER 115V	1				
folder 533									
5950-01-020-6000		3184757		TRANSFORMER POWER 115V	1				
folder 535									
5950-01-050-1217		3223197		TRANSFORMER POWER	1				
folder 658				L504-000-444					
5950-01-115-2016		L504-000-464		TRANSFORMER POWER STEP	1				
folder 537				DOWN					
5955-66-124-8758		L567-000-013		OSC, CRYSTAL 3MHZ	1				
folder 988									
5961-01-020-3183		1001-3184654		RECT. SEMI-CONDUCTOR	1				
folder 540				DEVICE					
5961-01-112-9485	5961-66-101-7407	L519-000-018		RECTIFIER DIODE	1				
folder 541				FULL WAVE					
5961-01-114-9952	5961-66-101-7291	L570-000-154		LAMP LED INT RESISTOR	2				
folder 543									
5961-66-101-7446		L519-000-012		RECTIFIER SEMI-CONDUCTOR	1				
folder 545									
5961-66-124-8759		L531-003-259		SEMICONDUCTOR DEVICE	1				
folder 889				DIODE.					

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NEW DSN	OLD DSN	MFR PART NO	TYP	DESCRIPTION	SAL	HELD	STOWAGE	SUR	DEF
5961-66-124-8842		L531-003-311		SEMI-CONDUCTOR DEVICE	1				
folder 902				OPTO/ISLR					
5962-00-542-9418		L537-300-046		MICROCIRCUIT LINEAR	1				
folder 905									
5962-00-584-3976		L537-300-047		MICROCIRCUIT LINEAR	1				
folder 906									
5962-01-035-2479		L537-300-053		MICROCIRCUIT DIGITAL	1				
folder 903									
5962-01-050-0718		L537-300-091		MICROCIRCUIT DIGITAL	1				
folder 904									
5962-01-069-0419		L537-300-220		MICROCIRCUIT DIGITAL	1				
folder 897									
5962-01-081-6319		L535-990-033	EYA	MEMORY RANDOM ACCESS	2				
folder 898									
5962-01-114-3160		L537-027-400		MICROCIRCUIT DIGITAL	1				
folder 901									
5962-01-199-2079		T537-020-802		MICROCIRCUIT DIGITAL	1				
folder 895									
5962-66-114-0041		T537-003-902		MICROCIRCUIT INTERFACE	1				
folder 875				BUFFER					
5962-66-124-7840		T537-039-204		MICROCIRCUIT LINEAR	1				
folder 878									
5962-66-124-7841		L200-013-657		EPROM, W/CUSTOM PRGM	1				
folder 874									
5962-66-124-7844		L537-111-037		MICROCIRCUIT PROGRAMABLE	1				
folder 879									
5962-66-124-8743		T537-036-202		MICROCIRCUIT DIGITAL	1				
folder 885									
5962-66-124-8757		L537-000-500		MICROCIRCUIT NMOS	1				
folder 887									
5962-66-124-8761		T537-038-902		MICROCIRCUIT DIGITAL	2				
folder 891									
5962-66-124-8761		L537-300-050		MICROCIRCUIT DIGITAL	1				
folder 890									
5962-66-124-8791		T537-209-123		MICROCIRCUIT DUAL	1				
folder 892									
5962-66-124-8793		T537-210-123		MICROCIRCUIT VOLTAGE	1				
folder 893									
5962-66-124-8794		T537-039-502		MICROCIRCUIT DIGITAL	1				
folder 894									
5962-66-124-8836		L537-000-520		MICROCIRCUIT REGISTER	2				
folder 897									
5962-66-124-8837		L537-300-187		MICROCIRCUIT DIGITAL	2				
folder 898									
5962-66-124-8838		L537-000-442		MICROCIRCUIT	1				
folder 900									
5962-66-124-8844		L537-000-459		MICROCIRCUIT	2				
folder 903									
5963-01-021-6237	1220-01-021-6237	L535-990-047	FVC	CIRCUIT CARD ASSEMBLY	1				
folder 819									
5990-01-112-9[illegible]5	7050-66-101-7558	L407-000-051		ENCODER	1				
folder 882									

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NEW DSN	OLD DSN	MFR PART NO.	TYP	DESCRIPTION	SAL	HELD	STOWAGE	SUR	DEF
5999-01-061-8576	1220-66-092-4799	A16		INTERFACE SELECT	1				
folder 554									
5999-01-061-8577	1220-66-092-4800			OPERATION CONTROL	1				
folder 555									
5999-01-061-8578	1220-66-092-4801			NTDS INTERFACE	1				
folder 556									
5999-01-061-8579	1220-66-092-4802			MEMORY	1				
folder 559									
5999-01-061-8580	1220-66-092-4803			MEMORY CONTROL	1				
folder 561									
5999-01-061-8581	1220-66-092-4804			SELECT CONTROL	1				
folder 563									
5999-01-085-[illegible]	6130-66-100-1951	L501-000-281	PNL	P/S PNL	1				
folder 55									
5999-01-110-[illegible]	1220-66-106-5647	L535-990-056	RFL	CIRCUIT CARD ASSY	1				
folder 851									
5999-01-111-3059	1220-66-101-7569	L536-000-332		ELECTRONIC COMPONENT ASSY	1				
folder 892									
5999-01-111-3064	1220-66-101-7268	L535-000-525		CIRCUIT CARD ASSY LIMT SEN	1				
folder 893									
5999-01-111-3065	1220-66-101-7540	L535-990-055	RGA	MULTIVIBRATOR MONOSTABLE RGA	1				
folder 894									
5999-01-112-[illegible]	5999-66-102-6444	L219-000-032		EXTRACTOR P/C BOARD	1				
folder 895									
6105-66-101-7271		L408-000-058		MOTOR ASSY	1				
folder 896									
6105-66-101-7283		L408-000-059		MOTOR ASSY	1				
folder 897									
6110-01-081-3385	6110-66-100-1952	L418-990-001	FPM	REG FPR	1				
folder 898									
6130-01-081-3412	6110-66-100-1953	L535-990-053	FPN	REGULATOR FPN	1				
folder 599									
6130-01-113-4307	1220-66-101-7447	L501-000-282		POWER SUPPLY DC-DC CONVERTER	1				
folder 600									
6130-66-116-3871		L501-000-316		POWER SUPPLY AY.	1				
folder 882									
6210-01-020-3162	5961-01-020-3162	3184863		LAMP LIGHT EMITTING DIODE	1				
folder 601									
6210-66-102-5243		T314-012-402		HOUSING SWITCH INDICATOR	1				
folder 602									
6210-66-124-7620		T406-005-824		INDICATOR LIGHTED	1				
folder 873									
6240-01-029-3584		L570-000-144		LAMP INCANDESCANT	10				
folder 603									
6240-66-101-7378		T570-004-602		LAMP NEON TI-3/4	2				
folder 654									
6625-01-083-0955	6125-01-083-0955	L501-000-279	EHT	POWER SUPPLY 15K VOLTS TWFCSI/CRT.	1				
folder 655									
6625-01-112-9387	5962-66-101-7287	T200-045-303		DISPLAY LED	1				
folder 656									
6665-01-114-9982	6210-66-102-5245	T314-012-707		HOUSING INDICATOR	1				
folder 657									

UNCLASSIFIED

UNCLASSIFIED
SWUP SUPPORT SPARES

NEW DSN	OLD DSN	MFR PART NO.	TYP	DESCRIPTION	SAL	HELD	STOWAGE	SUR	DEF
7025-66-124-7010 folder 372		L200-015-588		DISPLAY ASSY	1				